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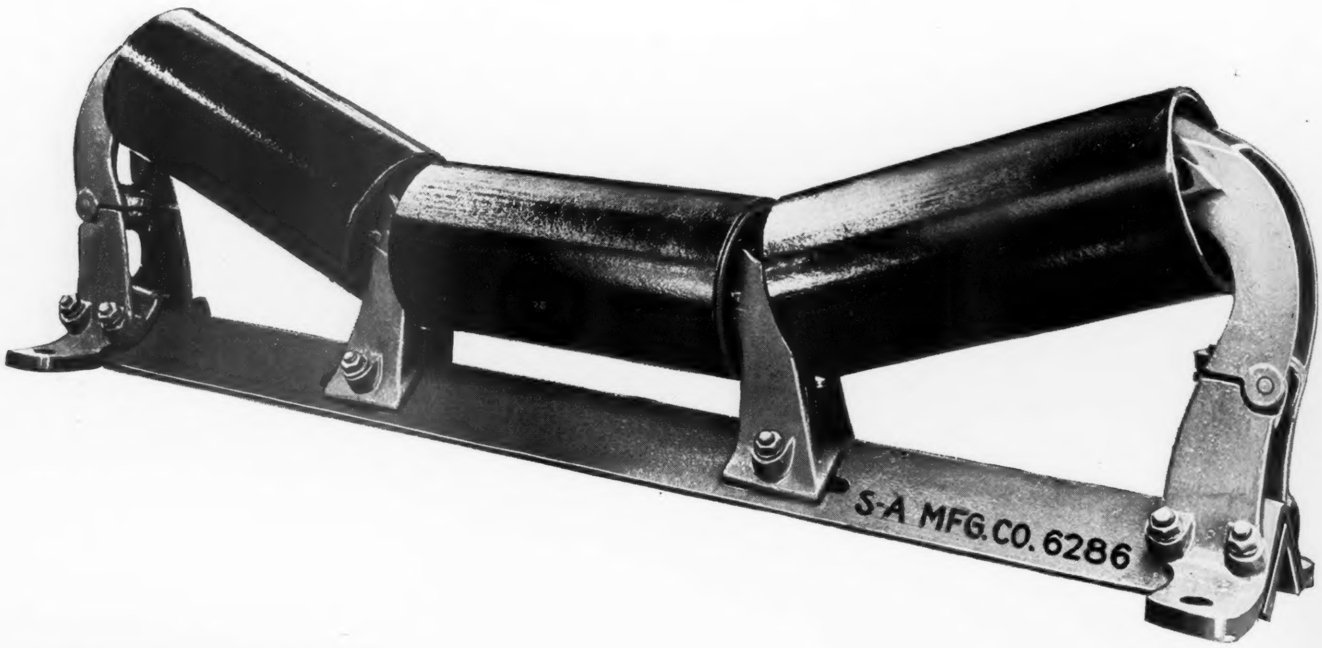
SACON CARRIER



Every big belt conveyor deserves a good carrier. The economic operation largely depends on this item of equipment. The smooth, easy-turning rolls on the high grade ball bearings reduce the ultimate horse power required to operate the belt.

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PACIFIC FACTORY LOS ANGELES

BRANCHES IN PRINCIPAL CITIES

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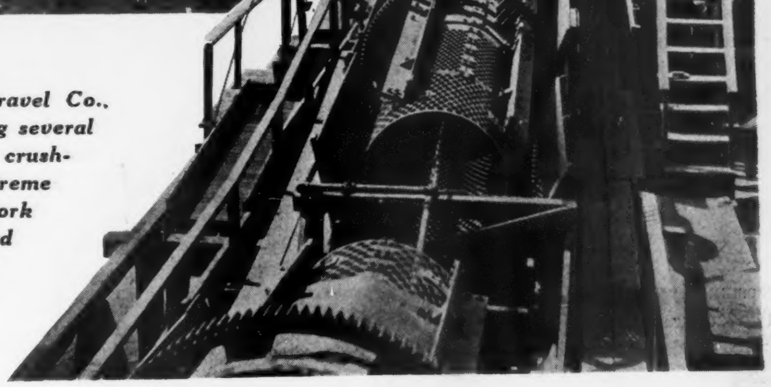
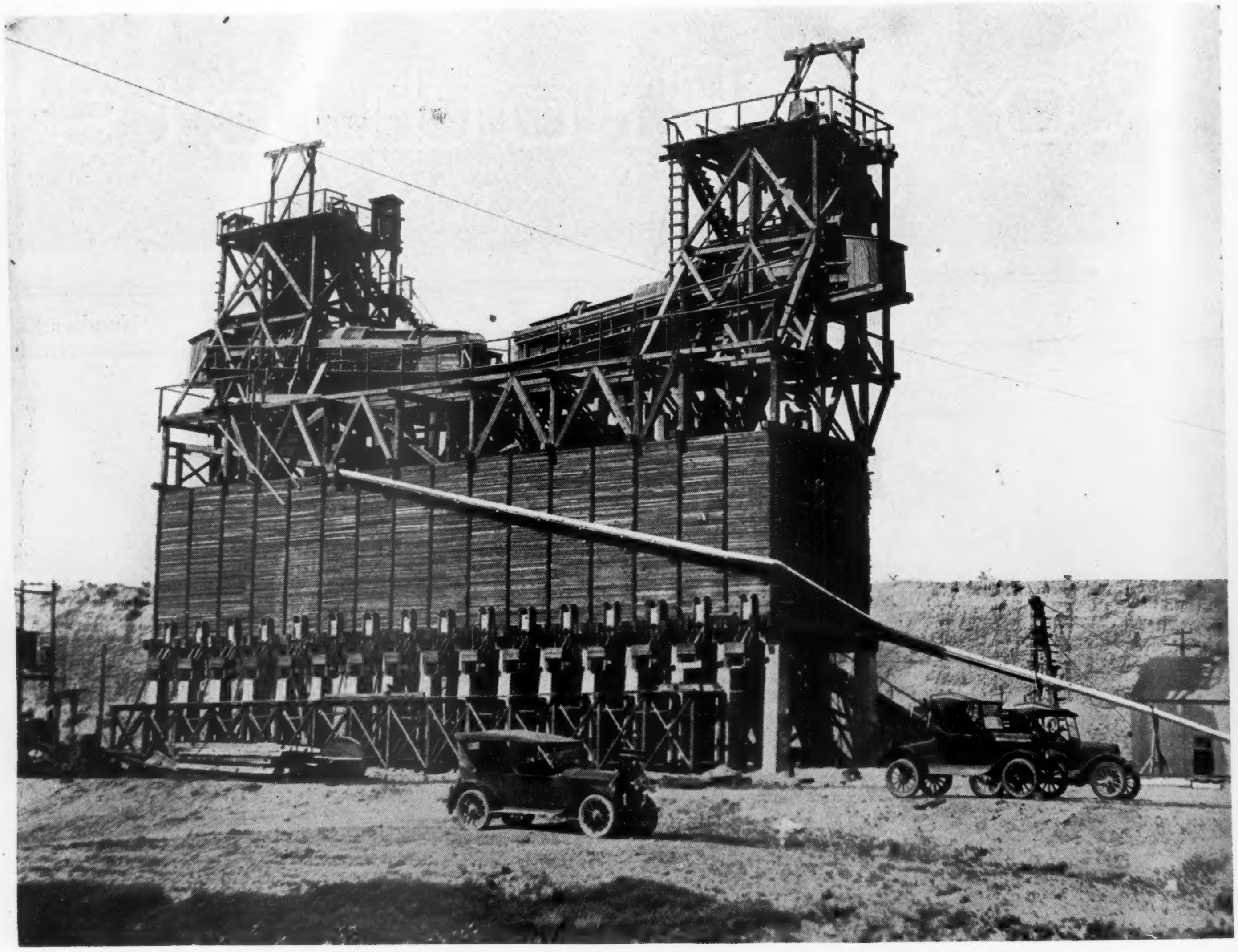


THIS new plant of the Bakersfield Rock and Gravel Co., Bakersfield, Calif., is working a deposit comprising several different kinds of material, much of which requires crushing. The crushing equipment is characterized by extreme flexibility of action, readily adapting itself to the work to be done. Complete washing equipment is installed at each end of the plant. The deposit includes small quantities of precious metal, and means for recovery are being provided.



On this side of the bins a belt conveyor for mixing of sizes is to be installed

New Stone and Gravel Operation at Bakersfield, Calif.

Careful Washing and Sizing Characterize This Plant — Some Precious Metal Is Recovered

THE Bakersfield Rock and Gravel Co. has recently completed at a cost of about $150,000 a modern stone and gravel plant near Bakersfield, Calif. While not a large plant, producing about 100 tons per hour, it has many interesting features, among which is a riffle above the sand washer to catch the gold which is present in varying amounts in the sand.

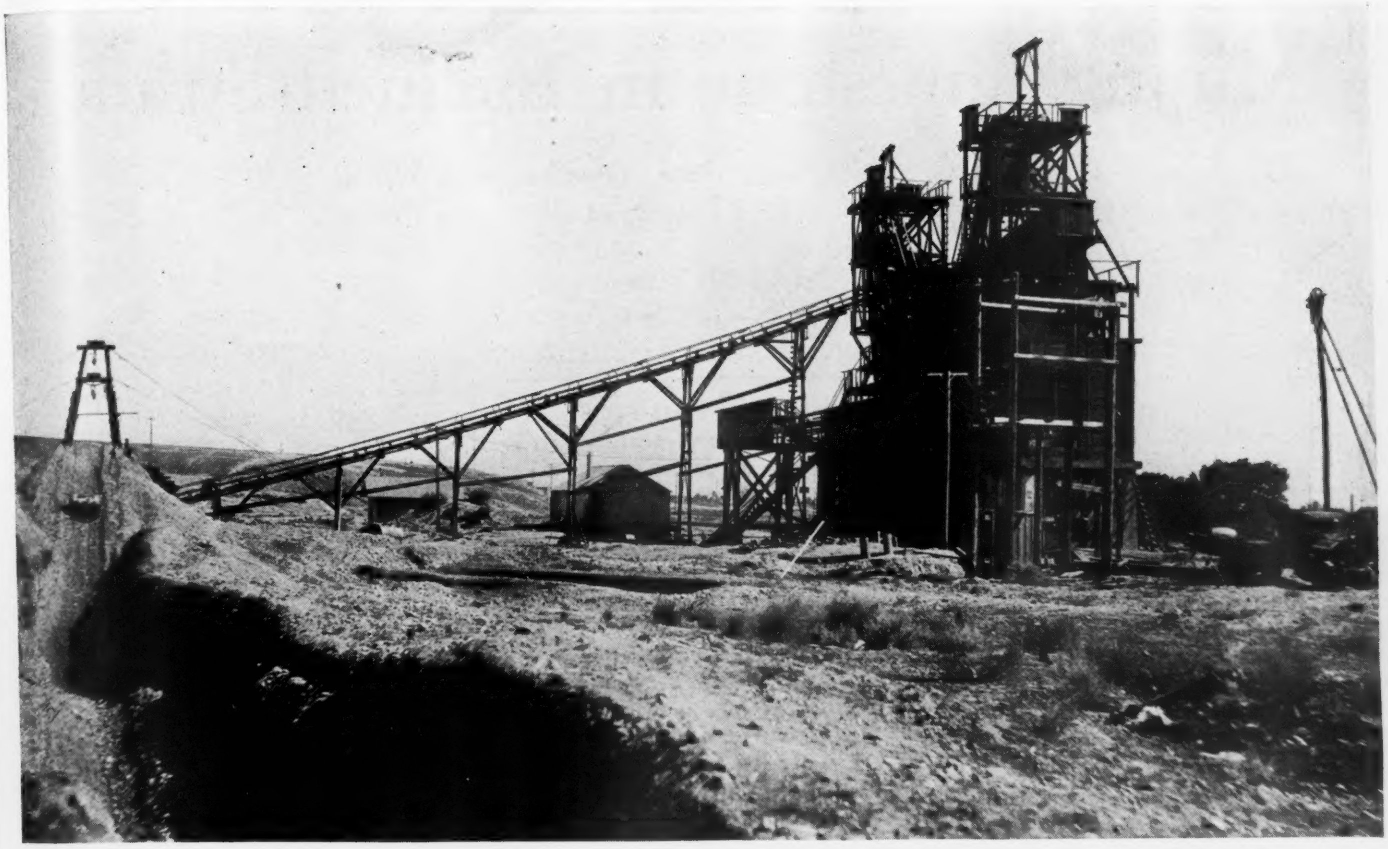
Just how much precious metal it may be possible to recover has not yet been determined. Now and again the operators find the gangue from vein fillings, some of which presumably carry values in gold and silver. The amount of precious metal in the sand is to be determined by a milling test, and if present means of recovery are not adequate, some other means will be taken to save it. Before this can be done, however, a second well will have to be drilled to furnish sufficient water for washing purposes, as the first well, drilled to a depth of 75 ft., failed to furnish an adequate supply.

Much Crushing to Be Done

The deposit being worked consists of various kinds of rock, including diorite, trap rock, quartz and a small amount of altered granite. A considerable amount has already been removed, leaving a bank nearly 1000 ft. long with an average height of approximately 40 ft.

Preliminary tests made by the Raymond G. Osborne Laboratories show the pit to contain 53% of material larger than 1½ in. and retained on ¼ in. and 32% passing ¼ in. About 20% would be retained on a 4 in. screen and 33% retained on a 3 in. screen.

The handling of the material at the pit is by means of a 2½-yd. Bagley scraper, operated by a 100-hp. Thomas hoist. The nature of the deposit, and the nearness of the plant to it, makes this a very satisfactory method of handling. The scraper dumps into a field hopper, from which it is fed on to a 30-in. belt conveyor through a pan feeder. This belt conveyor is 156 ft.



The plant is close to the deposit, and the method of excavation convenient and economical

c. to c. and delivers to a scalping screen located over the bins and about on a level with the rotary screens and scrubbers. The scalper is 48 in. in diameter by 20 ft. long, and contains 6 ft. of ⅝ in. perforations, 4 ft. of 1½ in. perforations, 4 ft. of 3 in. perforations, and 3 ft. of 4 in. perforations and blanks to cover gears and tires.

Three Crushers of Various Types

From the scalping screen the rock goes to three different crushers, according to size. The oversize goes to a 12x24-in. Cedar Rapids jaw crusher, the 4-in. stone to a No. 4 Gates gyratory and the 3-in. product to a 36-in. Symons disc. But this arrangement admits of considerable flexibility, so that any size from the scalping screen can be diverted to any crusher as unusual circumstances may make necessary or desirable, and sizes for which there is not sufficient demand can be returned to any crusher for recrushing.

From the crushers the rock goes to the rock elevator, which is of the continuous bucket type, 18 in. wide and 80 ft. c. to c., and is delivered to the centrifugal scrubber and screens on the rock side of the plant, the oversize from the screens returning to the disc crusher.

The smaller product of the scalping screen makes a similar travel to the gravel equipment on the opposite side of the plant, its oversize also returning to the disc crusher, or to such other of the crushers as most suitable for handling it.

Scrubber at Each Side of Plant

The scrubber at the head of each elevator consists of four manganese steel paddles, set between two steel discs and revolving at the rate of 400 r.p.m. These paddles cut the stream of rock or gravel 1600 times per minute, separating it sufficiently to give the water ample opportunity to carry away the dust and foreign material.

The screens are of special design, and were built by the Standard Boiler and Steel Works at Los Angeles. They are 48 in. in diameter and 42 ft. long. Both of these screens have 10 ft. of scrubber section in the upper end, in addition to the centrifugal scrubber above. The scrubber section is a solid steel barrel 48 in. in diameter by 10 ft. long, built of ½ in. steel plate, and containing a series of 10 in. screw flights with eight lifting flights placed between the screws in the circumference of the barrel. The next section contains 15 ft. of 9/16 in. perforations and following this is a 3-ft. section of ⅞ in. perforations, next 3 ft. of 1⅛ in. perforations, 4 ft. of 1⅝ in. perforations, 3 ft. of 2 in. perforations, 4 ft. of blank space for gears and tire and 14 ft. of wire cloth for sand jacket. All perforations except sand jacket are round. The sand, after passing over the gold riffles, goes into a Bodinson classifier.

Large Bunker Capacity

The bunker foundation is 105 ft. long, 4 ft. wide under each row of supports and 4 ft. deep. On top of this base are 34 reinforced concrete columns each 24x36 in. at the base and 18x24 in. at the top, and rising to a height of 14 ft. above the subbase. There are 17 columns on a side, set on 6 ft. 4 in. centers. The bunkers are cribbed with 2x6 in. plank sides and ends, and are tied over the columns with 2x4 in. cribbed partitions, making a total of 16 pockets 20 ft. high by 18 ft. 6 in. long and 6 ft. wide. The wall plates are 16x16 in. with 8x16 in. joists set edgewise, and without spacing, except where a space of 12 in. has been left for the gates. The joists have a clear span of 17 ft.

There are 16 slide gates in the bottom of the bunkers, and 16 rack-and-pinion gates on the side. Later there will be a 24 in. mixing conveyor belt under the side gates that will carry the material to the cars.

The company was organized and financed by C. F. Zenith, who is now secretary, and the plant was designed by J. R. Hughes, one of the directors. A. H. Karpe is president and J. B. Dowd vice president.

Wisconsin Road Contracts Pass $4,000,000 Mark

CONTRACTS for 147 miles of concrete highways at an estimated total cost of $4,342,737.20, and for nearly 200 miles of gravel and crushed stone roads at an estimated cost of $1,715,995, already have been awarded in Wisconsin this year, according to a report from the office of the state highway commission. This includes more than half the state's contemplated construction for 1926.

Mining Limestone in Inclined Strata

Some General Observations, Together with Working Details, From Two Important Producing Points

By J. R. Thoenen
Mining Engineer, Greenville, Ohio

THIS article continues the most interesting and practical series which Mr. Thoenen is writing for this journal, following the one on "Shrinkage Stope Method of Production," which appeared in the issue of June 12. The present article discusses a topic which is of vital interest to many limestone producers. Mineral deposits are not always placed by nature in position for easy working; and Mr. Thoenen's articles are of particular value in that they take conditions as they exist, define the problems involved, and then point the way out.

LIMESTONE is found in nature in every position from horizontal ledges to vertical veins or lodes. The angle of dip necessarily has great influence on the method of mining most applicable. In most limestone mines the strata are horizontal or nearly so. This class employ coal mine methods, or what is commonly called room and pillar mining. Rooms are usually driven at right angles from the main haulageway. Where the dip is slight the haul may be in any direction. Such deposits may therefore be opened from any side and worked in all directions. As the dip increases, more and more attention must be paid to the planning of haulage routes. There is no set rule for a maximum grade for mine haulage. Probably the extreme economic limit is reached at approximately 10%, or nearly 6 deg. At this grade a locomotive will just about haul a train the total weight of which is equivalent to that of the locomotive itself. At steeper grades the hoist is more economical, and in fact the hoist is preferable at this grade.

Limestone strata dipping up to 5%, roughly, can be opened from any side and operated in any direction. At dips of from 5% to 10% the direction of haul will determine the mining method employed. If the haulage routes are laid out parallel with the dip, material coming from the mine must be hauled up a maximum grade. With grades above 5% and up to the limit of 10%, haulage costs are high and in many cases prohibitive, although the distance hauled is a minimum. In order to overcome this difficulty and at the same time avoid the necessity of installing a hoisting system, a method of diagonal haulage is employed at some mines. This is illustrated in the accompanying sketch (Fig. 1), an ideal mine lay-out with a portion of the roof removed to show the internal construction.

In this sketch AC represents a tunnel or haulageway driven on the dip of the strata with the maximum grade and shortest distance. Working rooms are laid out at right angles to this haulageway. In order to provide more suitable grades, a second route has been laid out from B to C. The points A and B, being on the line of strike of the ledge, are at the same elevation with respect to the point C. The distance from A to C is, however, much shorter than from B to C, and hence a simple calculation will show that the grade BC is much less than AC, although the hauling distance is greater. In this particular case the dip is 10% or 6 deg. and the relative grades are shown by the triangles.

Suitable Grades for Haulageways

In this manner, by driving the haulageways at the required angle with the dip to provide suitable grades, and driving the rooms parallel with the strike, the ledge can be worked out, even though the dip is greater than permissible for haulage.

Another solution of this problem is found in driving the rooms themselves at such angles with the dip as will provide suitable haulage grades. In this case haulage routes are parallel with the rooms. Communication between rooms must be accomplished by means of long diagonal passageways or at right angles through short but excessive

Looking down the shaft

Looking up the shaft

Type of underground chute

Underground rotary car dump

grades. This latter system presents problems in operation that require constant attention. Both rooms and haulageways are driven at angles with the dip and strike. Unless the mine is large enough to warrant the employment of an engineer to keep headings in alignment, rooms are very easily diverted, resulting in grades lower or higher than planned. In the former case, rooms being parallel with the strike can be kept so by simply keeping the grade of the track level.

As the dip of the strata increases above 10%, diagonal haulage decreases in efficiency owing to lengthened haul. Where the lateral area of the property is limited, the diagonal route reaches the boundary before much depth is reach. The result is the use of switchbacks or zigzag routing. It is doubtful if this method of haulage offers much in the way of economy over a hoist and inclined shaft on the dip.

With strata dipping from 10% or approximately 6 deg. to 45 deg., probably the most economical method of mining is by means of the inclined shaft or slope driven on the dip and rooms driven at right angles along the strike. This applies to thin to medium thicknesses of stone. Where the stone is of great thickness other methods may be preferable, as will appear later.

North Georgia Marble Products Co., Whitestone, Ga.

In limestone mines or quarries, especially those burning lime, a problem encountered is the disposal or utilization of small sized stone or spalls. At some plants as high as 50% to 60% of the material mined is wasted because of its small size. The operation of the North Georgia Marble Products Co., Whitestone, Ga., differs in this respect, as no stone is marketed larger than ⅜-in.

The company operates two shafts or mines on the same ledge of stone; but as the methods employed differ only in minor details, only one, or the No. 1 plant, will be described.

The stone deposit is a thinly laminated white dolomitic marble with cleavage planes ½ in. to 2 in. apart. This thin cleavage prevents the use of the stone for building or ornamental purposes, for which it would otherwise be admirably suited. The stone outcrops in the side of a hill and is known to extend for a distance of approximately one mile in length, running northeast and southwest and dipping into the hill from 18 deg. to 22 deg. to the southwest. The overburden varies in thickness from a few feet to 400 ft. of limestone, sandstone and dirt. At the south end of the outcrop the marble stratum is only 20 ft. thick, but in the center and north end this increases to 40 ft. The parting between the marble and the overlaying strata is very smooth and clean, affording ideal roof conditions.

Mining is started by driving an inclined shaft or tunnel on the dip (Fig. 2). Contrary to the usual practice, this shaft is carried the full height of the stone and approximately 30 ft. wide. It therefore presents the appearance of an inclined tunnel or room rather than of the usual shaft. From this incline, rooms are driven along the strike at right angles. Room floors are kept level both longitudinally and transversely, but the roof follows the dip. This method leaves a triangular prism of stone in place below the floor on the lower side of the room. Advantage is taken of this in dumping cars into the hoisting skip.

Rooms are driven 35 ft. wide on 70-ft. centers with ribs or continuous pillars of the same size between. Side walls of the rooms are cut normal to the dip and not vertical, thus allowing the pillars to support the roof without excess cross-sectional area. Rooms and pillars alternate on either

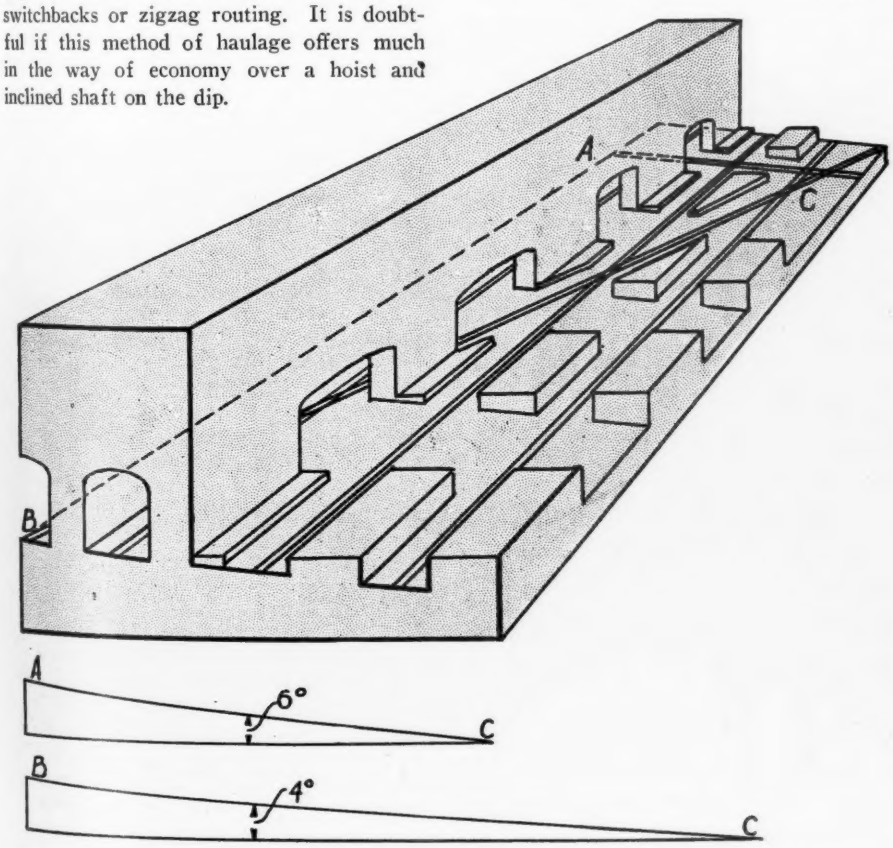


Fig. 1—Showing method of reducing grade of haulage

Headframe at plant of American Zinc Co.

side of the shaft. The shaft is carried a short distance below the last room and forms a water sump to which all underground water is drained and from there pumped to the surface.

Rooms are advanced by a simple semi-circular breast stope just below the roof, using no wedge cuts. This is followed by underhand benches. Breast holes, three in each vertical row, are drilled 12 ft. long. Six bench holes carry the room width of 35 ft. and are drilled 12 ft. deep, with 3½ ft. of burden. Drill runners average 150 ft. of drilling in a 10-hour day.

Stone Breaks Easily with Little Blockholing

Holes are shot with 40% gelatine dynamite using electric delay exploders and No. 6 caps. Owing to the thinly laminated character of the stone, it breaks up easily and only about 1% of the explosive used is for secondary blockholes.

Sullivan hammer drills are used, mounted on columns for the breast holes and unmounted for the benches; ⅞-in. hollow hexagon steel is used throughout with 4-point or square bits.

Broken stone is loaded by hand to steel front-dump cars and trammed to the shaft or hoisting tunnel. A rough cribwork trestle is built at the room portal into the shaft and the cars dumped direct into a 1½-ton steel skip. By leaving the room floor level, sufficient elevation is thus obtained for this direct dump to the skip, which follows the dip of the stone.

Stone is hoisted to surface and dumped to a hopper over a No. 4½ Champion jaw crusher set at 2½ in., from which it passes by gravity to a No. 3 Williams hammer mill. The crushed material is then raised in a 7x12-in. bucket elevator on 60-ft. centers to the scalping trommel, 40 in. by 12 ft. in size, and fitted with a 48-in. dust jacket. The scalper has ⅜-in. round holes and the dust jacket ⅛x1-in. slots cut longitudinally.

Oversize from the scalper drops to a No. 1½ Sturtevant rotary crusher and is returned to the elevator in closed circuit.

Oversize from the dust jacket goes to two trommels in tandem where No. 1 (material minus ¼ in. and plus ⅛ in.) and No. 10 (material minus 11/32 in. and plus ¼ in.) stucco and terrazo are made. Material passing ⅜ in. and retained on the 11/32-in. screen is sent to a rotary crusher in closed circuit for further reduction or sold as No. 3 stone.

Undersize from the dust jacket (minus ⅛ in.) goes to a ring-roll mill and by bucket elevator to the top of a 10-ft. Sturtevant air separator, which removes material 80% through 200-mesh for asphalt filler. Oversize goes to a drag elevator and to a Newaygo screen making agricultural stone (minus 40-mesh). Plus 40-mesh is elevated to a "Rotex" screen where three products, varying from ⅛ in. down to 40-mesh, are made.

American Zinc Co., Mascot, Tenn.

The American Zinc Co. at Mascot, Tenn., while essentially a metal mining operation and therefore hardly to be classed as a limestone mine, nevertheless produces a large tonnage of limestone. In fact, from a purely tonnage standpoint this operation might be truly classed as limestone mining with zinc as a by-product.

Inasmuch as the mining and milling methods employed by this company have been very completely described and illustrated in other publications,* merely a short description will be given here.

The ore is found in small, widely disseminated veinlets together with similar veinlets of dolomite in a dolomitic limestone. This necessitates the mining of large tonnages of limestone to recover relatively small tonnages of the ore itself. This excess of limestone was formerly wasted as mill tailings,

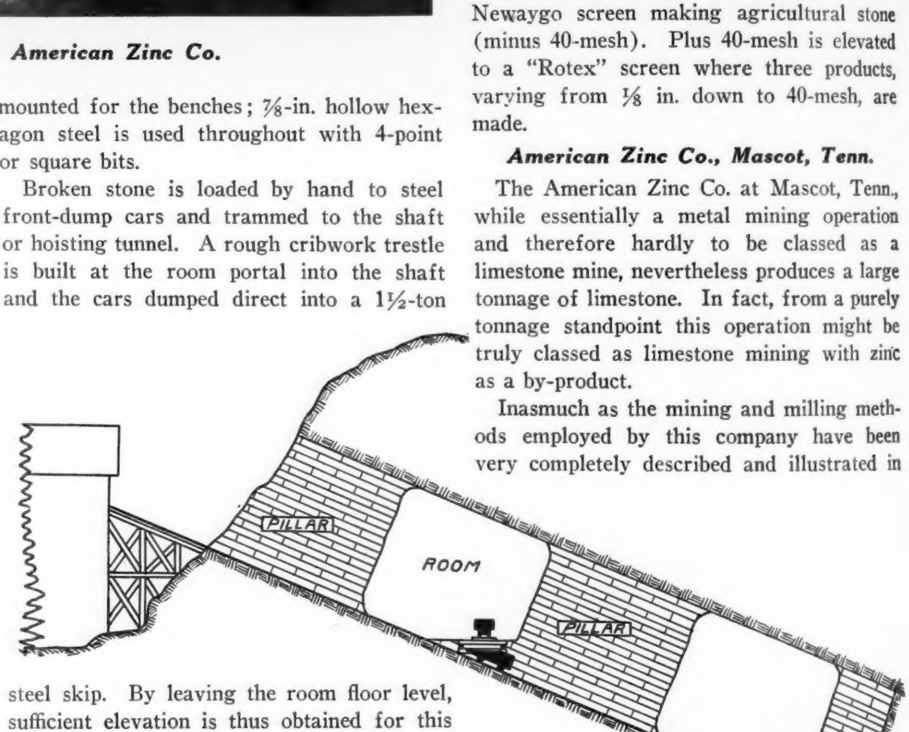


Fig. 2—Vertical section through shaft

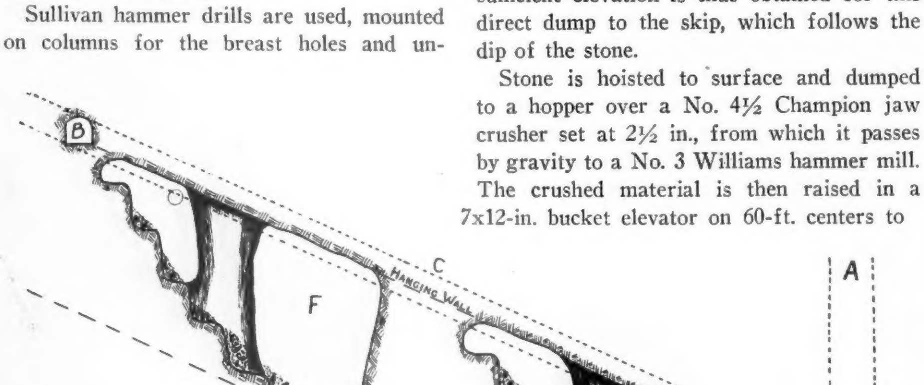


Fig. 3—Vertical shaft sunk first

*Trans. A. I. M. M. E., paper read at Birmingham meeting, Sept. 1924, "Mining Methods at Mascot, Tenn.," by H. A. Coy and J. A. Noble. Eng. and Min. Jr-Pr., Vol. 118, No. 11, p. 407, Sept. 13, 1924, "Mining Zinc at Mascot," by A. H. Hubbell.

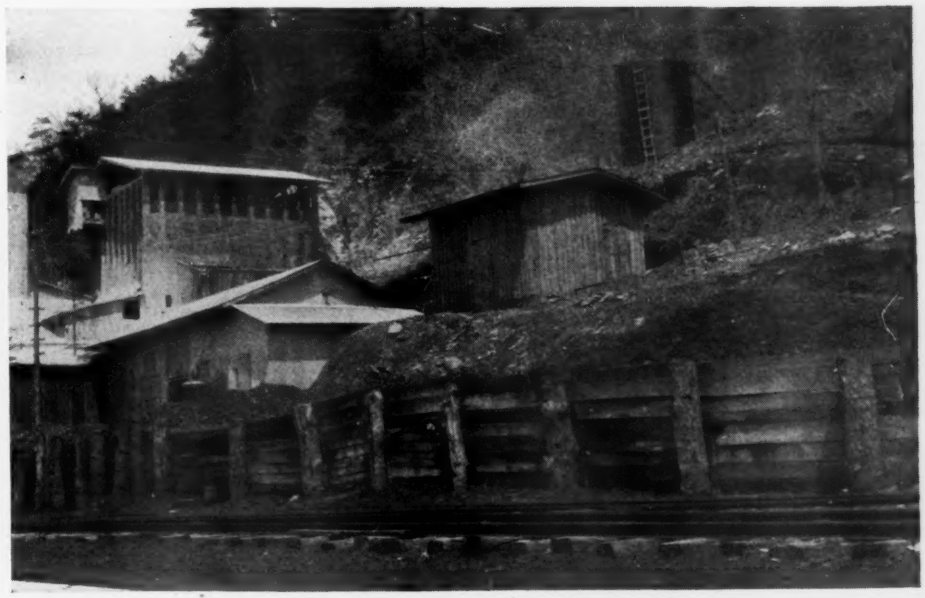
but recently has been marketed in increasing quantities until at the present time very little is wasted.

The ore-bearing stratum is the Knox dolomite, which strikes approximately 75 deg. east of north and dips about 22 deg. to the southeast. The mineralized portion of the stratum varies from 10 ft. to 130 ft. in vertical height and from 25 ft. to 150 ft. in width, and is very irregular in shape.

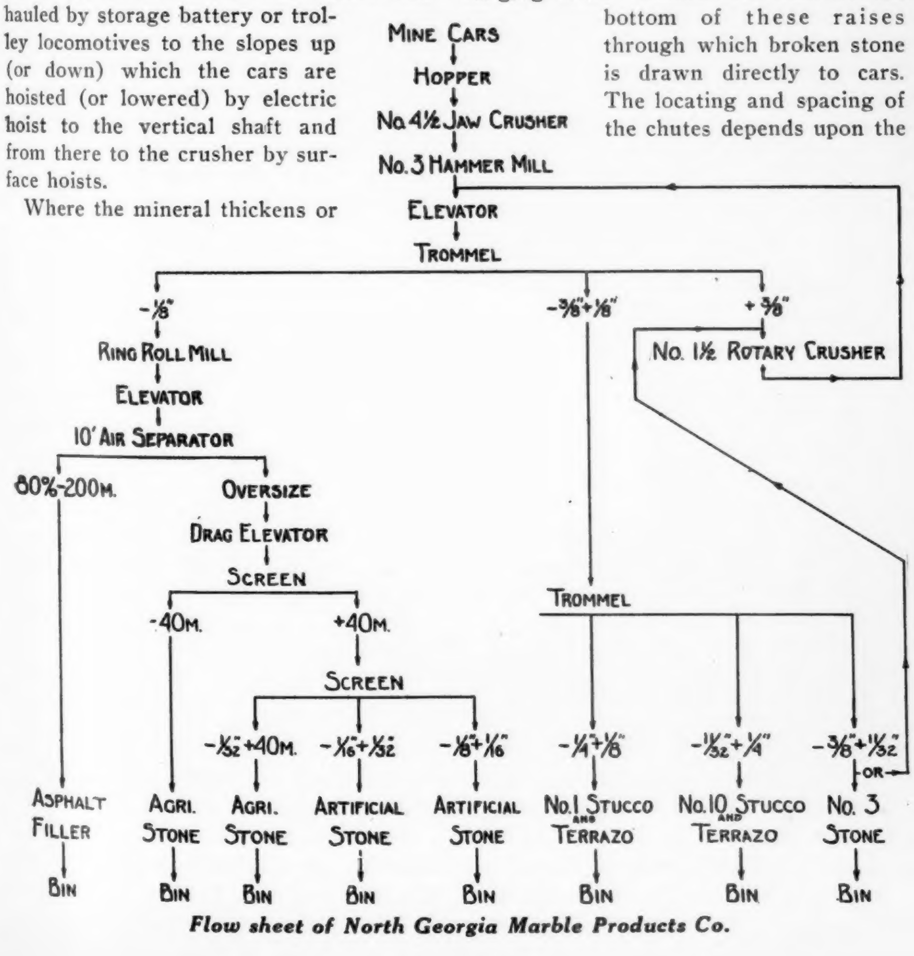
Formerly the shrinkage method of mining was employed with sub-level stoping, but this was later abandoned and now two distinct methods are used, viz.: breast and underhand stoping with mechanical or hand loading, and underground glory hole mining with chute loading. Fig. 3 is an idealized vertical section through this ore body parallel with the dip.

As the ore lies at considerable depth below the surface, vertical shafts were sunk to the mineralized area, as shown at A (Fig. 3). From these inclined stopes were driven both up and down the dip on the hanging wall or upper limit of the mineral (C). From these stopes main haulageways (B) were driven on the hanging wall and parallel with the strike of the ore. The breast stopes were started from these main haulageways or from intermediate drifts as circumstances required and driven up the dip following the hanging wall but keeping the floor level (E). As the breast increased in thickness underhand benches were employed. From these stopes the mineral is loaded by hand or mechanical shovels and hauled by storage battery or trolley locomotives to the slopes up (or down) which the cars are hoisted (or lowered) by electric hoist to the vertical shaft and from there to the crusher by surface hoists.

Where the mineral thickens or presents other favorable conditions the underground glory hole method is employed (F). To start this system, transverse drifts or crosscuts are driven from the slopes through the ore to and into the footwall. From these, main haulage drifts are driven in the footwall (D) parallel with the strike. Raises from the main haulage drift are driven up through the ore to the upper limit and then connected with the upper level by driving along the hanging wall. Chutes are built at the bottom of these raises through which broken stone is drawn directly to cars. The locating and spacing of the chutes depends upon the



Plant of North Georgia Marble Products Co.



Flow sheet of North Georgia Marble Products Co.

Starting a room from shaft

Bagging the product

amount of ore available at each particular point and is governed by the irregularities of the deposit. The tops of the raises are next enlarged funnel shape and the ore broken down into them by means of concentric breast and underhand stopes. Raises are kept filled with ore and large pieces are block-holed before they enter the raise. This method requires a minimum of handling of broken stone.

Round Pillars Are Justified in This Type of Mining

Round vertical pillars are left at suitable intervals through the stopes. In ordinary limestone mining where the ledge of stone is uniform and extensive, as well as inclined, round vertical pillars are not advisable because they do not offer support normal to the roof. In an irregular, comparatively narrow ore body such as this there is no large extent of unsupported ground and therefore no great need for pillar support except locally, hence occasionally round pillars of minimum size are warranted.

Room heading

Total mining costs, including development but without crushing and overhead, are given (A. I. M. M. E. report) as $0.7837, with development charges as $0.1328 per ton, leaving a net mine operating cost for ore delivered to the crusher on surface as $0.6509 per ton. There has been much hesitation among limestone operators to venture into underground operations owing to the belief that costs would exceed returns. The writer desires particularly to call the attention of limestone operators to the above costs as substantiating his contention that underground mining when properly prosecuted is not the expensive operation which popular opinion would have it. In this mine are found various causes for much higher costs, such as hand loading, double hoisting and extensive development. Costs as low as quoted in such mining conditions are eloquent of what can be done and reflect great credit on those responsible for them.

Crushed Stone Association Activities

THE July issue of *The Crushed Stone Journal,* published by the National Crushed Stone Association is especially interesting and instructive. An article by W. R. Sanborn, of the Lehigh Stone Co., Kankakee, Ill., a vice-president of the association on "A Study of the Mechanical Analysis of Crushed Stone," gives the results of a study made with his own stone, which is a dolomitic limestone. As a result of this study he has arrived at the following general law of crushing:

Sanborn's Law of Crushing

Stone normally breaks, in a system of gyratory crushers, so that the percentage of the product passing through any screen opening is directly proportional to the size of the screen opening.

His tests on a 11½-ton sample showed the following percentages passing various sized screens (round openings): 4½-in., 100%; 3½-in., 98.66%; 3-in., 89.92%; 2-in., 74.11%; 1¾-in., 63.06%; 1½-in., 52.16%; 1¼-in., 41.64%; (square openings) ¾-in., 31.13%; ½-in., 22.43%; ⅜-in., 13.04%; ¼-in., 7.01%; 1/10-in., 2.54%. These values plotted verify his general law. For example, a 2-in. round opening is 25% of a 4-in. round opening, and a 2-in. round opening passes approximately 75% of the crushed material that passes the 4-in. round hole, or 25% less.

In explanation of his tests Mr. Sanborn says: "The operator could make a most careful and systematic analysis of his plant, working under one set of conditions, with the very positive probability that those conditions would not generally represent normal operating conditions. Even while the test was being made, a delay in the quarry, causing a light load for a time in the crushing plant, would give inaccurate results.

The problems he was trying to solve were: (1) What is the normal gradation, if any, of the product of a particular system of gyratory crushers? (2) To what extent do circular (cylindrical) revolving screens do the work expected of them, and how does their product vary under different conditions?

Mr. Sanborn, and the editor, J. R. Boyd, are to be congratulated having given the crushed stone industry the results of a crushed stone plant research, which is doubtless the forerunner of much similar work to be done in the future. There is no reason to believe that Mr. Sanborn's results are applicable to stone-crushing operations generally, certainly not to trap rock or granite, and not very likely to other limestones. Each stone quarried has certain physical characteristics which probably affect the percentage of sizes crushed by a given system of crushers; and of course changing the system of crushers, if only changing the opening of one of the crushers, would probably affect the results. Other producers must run similar tests, and the results must be studied as a whole to arrive at any general laws of crushing and screening efficiency.

The same issue of the *Journal* contains an article by A. T. Goldbeck, director of the bureau of engineering of the association on the proposed standard for commercial sizes of crushed stone and a suggested compromise standard. Certainly every crushed stone producer should study this article, and any who have not received a copy of the *Journal* can doubtless obtain one by writing to the secretary of the National Crushed Stone Association, J. R. Boyd, 751 Earle Building, Washington, D. C.

Cubes as Grinding Media in Tube Mills

THE use of cubes in place of balls as grinding media in tube mills has occasionally been tried. Theoretically one would expect that the cube would eventually wear down at the corners and become a ball; but one of the arguments of the proponents of the cube method is the statement that this does not happen, showing that the contact is not point to point but face to face.

The subject is discussed in many of its details by E. H. Rose, mill superintendent of a Bolivian mining company, in *Engineering and Mining Journal* for July 17. Mr. Rose says that the most notable points of advantage over the use of balls are the following:

(1) Increased probability of trapping a number of particles at every blow, thereby minimizing blows of steel on steel without useful work.

(2) A multiplicity of bucking boards, between circumjacent cubes within the body of the mill charge while the cubes are returning to the ascending side.

(3) "Selective grinding"—as the surfaces approach each other they are held apart by the coarser material, which must break down before the finer material is touched.

(4) Avoidance of undesirable sliming, through "selective grinding."

(5) Wedging action against rock pieces, as surfaces of cubes under pressure approach each other obliquely, or in rotation.

(6) Absorption of energy in useful work. Because of the distribution of the area over which the force of any blow is applied, the descending cubes are brought to rest gradually by the progressive crushing of the coarser material, which acts as a brake in absorbing and effectively utilizing all of the kinetic energy of the descending cube.

(7) Uninterrupted action between surfaces of cubes under pressure within the cube load, until the material between them is crushed or the pressure relieved.

Calcination Rates of Limestone

Tests on Stone from the Santa Cruz Portland Cement Co. Quarry in California

By Wallace A. Gilkey
Stanford University, California

ALTHOUGH the lime-burning industry had such an early beginning, it still presents a promising field for scientific research. The calcination of limestone also plays an important part in the portland cement industry. The powdered limestone contained in the raw mix is all burned to lime in the upper part of the rotary kiln at a comparatively low temperature. It is then necessary to raise the mixture to a much higher temperature (about 1400 deg. C.) until a state of incipient fusion is obtained. The material partly fuses together to form cement clinker.

Because of the high temperatures required for the clinkering process and the large volume of air which rushes through the kiln, very high stack temperatures are produced and an enormous amount of heat is wasted. When it is considered that the average stack temperatures in a cement kiln are from 700 deg. to 850 deg. C., the large amount of waste heat is realized.

A new process for burning portland cement was under consideration in which the clinkering process would be carried out in a smaller furnace and the limestone content of the raw mix burned to lime by the waste heat in another furnace arranged in series with the first. The important question arose as to how fast the material could be passed through this calcining furnace—in other words, what are the rates of calcination of limestone at different temperatures? No answer to this important question is found in the scientific literature.

Procedure

A sample of selected limestone was obtained from the quarry of the Santa Cruz Portland Cement Co. The sample was of crystalline structure, varied in color from pure white to a light gray, and had the following analysis, according to the cement company:

SiO_2	1.22
Fe_2O_3	0.48
Al_2O_3	....
CaO	54.50
MgO	0.21
SO_3, K_2O, Na_2O	Traces
Ignition loss	43.37

The crushed and ground sample was carefully separated into sizes from 4 to 6 mesh to through 200 mesh by screening. The sample was thoroughly dried, although only a trace of moisture was present.

The procedure finally adopted was to heat the samples at different constant temperatures for different intervals of time in small porcelain crucibles in an upright, cylindrical 4x4-in. Hoskins electric furnace. The per cent of calcination during any time interval was determined by the loss of weight of the samples. Five samples could be heated at the same time.

The temperature of the furnace could be controlled by a rheostat connected in series with the furnace to a lighting circuit. Very good temperature control was obtained by this method and also by slightly raising or lowering the lid of the furnace for a few seconds. When making runs at the higher temperatures (above 800 deg. C.), where the rates of calcination were very high and the time of heating the samples was short, the temperature of the furnace was raised to a hundred degrees or more above that at which the rate of calcination was to be determined before the samples were placed in the furnace. The furnace cover was then removed and the crucibles were quickly placed in the furnace and the furnace cover placed in position. In this way the required temperature could be reached in a very short time compared with the time required for the run. At the highest temperatures (900 deg. to 1000 deg. C.) it was necessary to work very rapidly. By exercising great care the crucibles could be brought to the required temperature in a small fraction of a minute. At the highest temperatures the full current was turned on and the temperature of the furnace was controlled by raising or lowering the furnace cover. A current of air was drawn through the furnace in order to obtain as nearly as possible the conditions that would prevail in a cement kiln. Temperatures were determined by means of a Brown nichrome thermocouple. The instrument was found to be accurate to within 3 deg. C. for any temperature on the scale of the galvanometer, which read up to 1000 deg. C.

Results

As might have been expected, the rates of calcination were greatly influenced by the concentration of carbon dioxide in the furnace atmosphere. Samples in covered and in uncovered crucibles were heated at the same time at the same temperature and for the same time interval. The rate of calcination under atmospheric pressure of carbon dioxide was only about 40% of that obtained in uncovered crucibles in a current of air. There is need for more research to determine the effect of the concentration of carbon dioxide upon the rates of calcination.

It was observed that the coarser particles of limestone would begin to decrepitate when heated to about 570 deg. C. and that some of the material would thus be thrown out of the crucibles and lost. The crucibles could not be covered during the calcination because the reaction would be greatly retarded owing to the increased concentration of carbon dioxide. Experiments were performed which showed that practically all of the decrepitation could be accomplished by heating the samples in covered crucibles for about 10 minutes at 650 deg. C. The very small amount of calcination at this temperature for the short time interval could be neglected. Every sample was heated in a covered crucible at 650 deg. C. for 10 minutes before being placed in the furnace.

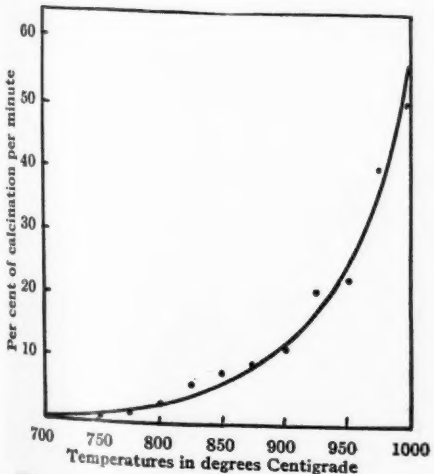
The rates of calcination were determined at 25-deg. intervals between 700 deg. and 1000 deg. C. It would have been practically impossible to have determined the rates of calcination of the limestone with any degree of accuracy at temperatures much above 1000 deg. C. because of the rapidity at which the reaction proceeds.

The accompanying graphs represent the results of determinations made on over 450 samples and were obtained from the average results plotted on a number of other graphs.

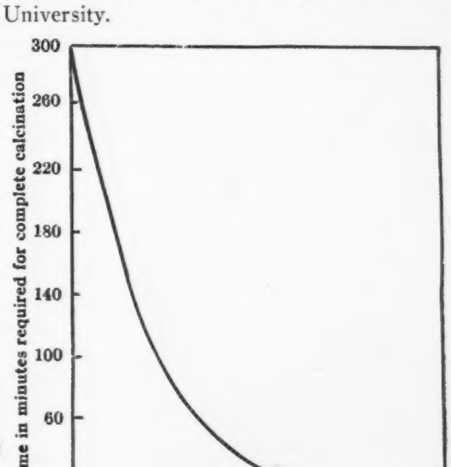
Acknowledgment

The research was carried out at the suggestion of Prof. S. W. Young of Stanford University.

From *Industrial and Engineering Chemistry* for July, 1926.



The rates of calcination of Santa Cruz limestone at different temperatures



Time required for the complete calcination of Santa Cruz limestone at different temperatures.

Extensive Utilization of Rock Products in Rapid Home Building

Editorial Correspondence From the Field, Describing an Unusual Development on the Part of a Philadelphia Builder

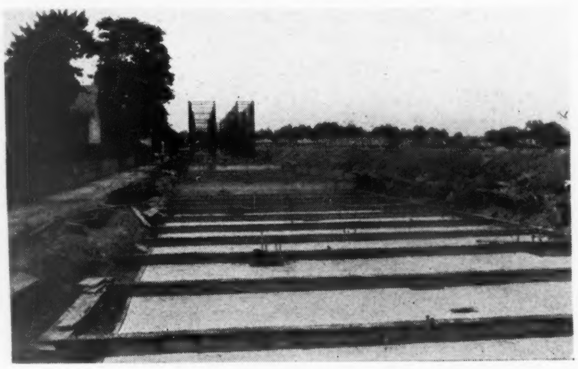
By Edmund Shaw
Editor, Rock Products

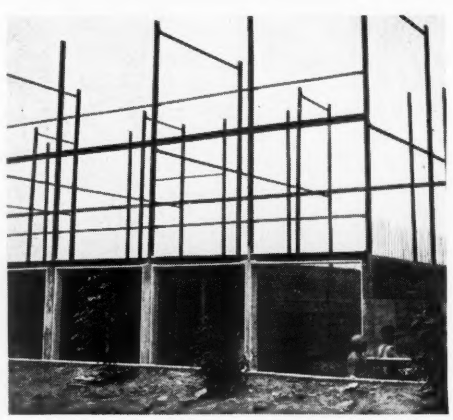
ORDINARILY on these editorial trips one is concerned only with the production of the materials in which all of us are interested and not with their uses. But occasionally one runs across a new use, or an old use that has been extended so that there may result a considerable increase to the rock products market. In that case, of course, every producer is interested.

I ran across such a use in Philadelphia two weeks ago in a new type of house construction, which, if it grows in popularity, will considerably increase the market for aggregates and cement. It is also interesting because of the employment of cementitious materials which are comparatively new, and which enable the builder to speed up construction to a remarkable degree.

John H. McClatchy is the builder of these new-type houses and he is putting up 132 of them in the blocks of which pictures are shown. He is developing a plot of ground on which perhaps 600 of such houses will be placed eventually.

Mr. McClatchy is in the business of home building in a large way; his last year's record was 880 completed dwellings. Building them in such number he can apply the economics of large scale production and he can also afford to employ trained engineers or experts to supervise every part of the construction. Those who were at the convention of the National Lime Association will recall the paper by J. P. Mollenkof on lime stucco. Mr. Mollenkof is one of Mr. McClatchy's associates and he has charge of all stucco and interior plaster work and ornamental concrete work. It was through his kindness that the notes for the present article were gathered.





Sample Houses Erected

Before beginning an operation involving the building of a large number of houses, Mr. McClatchy has a sample house erected and furnished and lawns and shrubbery placed around it to show how it will appear when it is occupied. Selling starts at once and usually every house is sold before the first house is completed. In building samples of this new type house something of a record was made. A block of four apartments, two upstairs and two downstairs, was built in exactly four days. This included plumbing, lighting and heating fixtures, preparing the lawn, planting shrubbery and moving in the furniture. As the building is practically all of concrete, quick-setting and quick-hardening materials had to be used throughout in order to make such speed. No attempt to break any records is going

These illustrations show progress of construction, with garage floors in place at top, and steel and concrete following

on in the building of the 132 houses, but the construction is very fast. It would not be surprising if the rate of a dwelling a day were maintained there, if one may judge from the way the work was going when the operation was visited.

Each dwelling (or apartment) has a garage underneath. Above this are a large living room, a bedroom, kitchen with breakfast nook which is used as a dining room, and a handsomely equipped bathroom with tiled floor and walls. It sells for $3750, a cash payment of $500 being required. The carrying charge is only $32.75 per month and this includes interest, taxes, water rent, payment on principal and a charge of $18 a year for management expenses, which includes caring for lawns. To rent the same space in an equally good neighborhood with the same transportation facilities would cost three or four times as much in the ordinary American big city.

In starting a row of buildings the ground is first leveled off and the foundations and the floor of the garage are poured from portland cement concrete. The tops of the foundations are covered with a bituminous mastic to keep the dampness of the ground from affecting the walls and partitions. Steel forms are set up and walls and partitions are poured. Cinder concrete is used for the outside walls and "Structolite," the new gypsum concrete, is used for partitions. Steel I-beams (4 in., 7.3 lb. to the foot) are set up to take the weight of floor and roof. This is all the reinforcing used in the walls except some short rods that serve as dowels to connect the walls at the floor levels.

Early Strength Cement Used

The floors are poured from "Lumnite" cement concrete which attains a strength of 3000 lb. in 24 hr. A 1:2:4 mix is used, the aggregates being sand and gravel, most of which come from the Tullytown district near Trenton. Cinders are used for aggregate in the outside walls and they are preferable on account of the light weight. But other aggregates could be used as well so far as construction is concerned. Sand and gravel are used to make the "Structolite" concrete in the partitions.

Forms Designed for This Work

The steel forms are of a design which has been worked out for this job and which is being patented. These forms go together rapidly and are rigidly held in position when they are in place. For carrying up the outside walls, rising forms of wood are used on the outside, as is shown in the pictures.

The underside of the floor slab makes the ceiling of the room below. The forms for this ceiling are coated with a compound which keeps the "Lumnite" cement on the surface from setting. When the forms are removed the ceiling is brushed off, leaving a pebbled surface to which plaster can be applied without furring or lathing.

Sample block of four dwellings put up in four days

The partition walls of "Structolite" have a very smooth surface and experiments have shown that wall paper may be directly applied to this surface. However, the cost has been figured on a basis of plastering all walls, as this is considered better construction.

Roofs are of concrete and reinforced. There are a number of interesting details that might be added to this brief description, but with the aid of the photographs the method should be clear. The main elements are: The use of steel of sufficient size to take the weight of the structure when embedded in concrete, the use of quick setting and hardening cementitious materials that will allow the work to go on without waiting over 24 hr. for any part of it, and a design that lends itself to quick and economical construction; for example, there is no cellar, as a gas-fired hot-water system is used for heating.

Housing Is Pressing Problem

All over the civilized world the question of housing the population of cities is pressing. In English cities municipal and state building of dwellings has been found necessary and apparently it will be tried out in New York City. At least it has been strongly advocated by Governor Smith. And the answer to the problem seems to be concrete in one form or another. Concrete block and tile construction has become deservedly popular. The cost is hardly more than frame construction and is considerably less if the maintenance of the building is figured in.

In Germany, France and Holland some success has been had with larger precast units—panels that are handled with a traveling crane. These panels are precast on the ground to save the difficulty of transporting such large pieces. Special forms have been devised to admit of rapid forming and placing of the concrete. Then there are the form systems applied to masonry units such as brick and stone. In this country the Flagg system, which uses field stone or larger pieces of quarried stone (one man size), has been used in some beautiful dwellings. In Europe, especially in England, attempts have been made to lay up brick in forms, so that

Left to right: John McCreary, building supply dealer; O. M. Calhoun, engineer in charge of construction, and J. P. Mollenkof, in charge of plaster, stucco and ornamental concrete work

unskilled labor could do the work. Such systems are really applications of the concrete method. Experiments have been made, I believe, in building a complete house with a cement gun. Whatever the method proposed to hasten and cheapen building, it somehow brings in concrete in one form or another. Of course, "Structolite" is classed as a concrete here, although its base is gypsum. And gypsum in one form or another has many potentialities for speeding and cheapening construction, which have by no means reached their full development.

Interior of 4-day sample house

Machinery Used Whenever Possible

Speed and the use of machinery in the place of men wherever possible seem to be the principles of the newer construction. The resulting structure must be fireproof, waterproof and vermin proof. It must be pleasing to the eye and flexible in its adaptation to various styles of architecture. And it must be mainly of inexpensive materials. Some form of concrete would seem to fill all these requirements better than any other building material. This is not saying that it is to crowd out all other kinds of building material, for we are speaking now only of materials for cheap and rapid dwelling construction, the necessity for which is so pressing in all parts of the world.

The rapid increase of urban populations is recognized to be the outstanding feature of our modern civilization. Its cause is no mystery. The work that was formerly done on the farms and in the homes is being done in factories and the people are going where the work is. No one can say how long the movement will continue, but the present growth of cities is very steady. Chicago grows at the rate of 70,000 per year, according to official figures, and the growth of New York is considerably greater. Each new inhabitant requires new construction, not only for housing but for work and convenience. There must be more roads, bridges and sidewalks, and more factories, warehouses and stores to accommodate this growth. How much should be spent to build all these no one can say, but figured on a basis of population we do not spend much money for building. Assuming the population of the United States to be 115,000,000 and our last year's construction to be $6,250,000,000, it figures less than $55 per inhabitant or about the cost of a man's suit. If we figure only the yearly increase in population, which is about 1% of the whole, we have only $5435 as our annual construction cost per *new* inhabitant, which is less than the cost of a good middle-class home in a big city. It is no wonder that housing problems are pressing and that each year sees an increase in construction of all kinds.

Determination of Uncombined Lime in Portland Cement*

NONE of the methods proposed for the determination of free lime in portland cement has been accepted generally as an adequate quantitative procedure. The difficulty in determining this free lime lies in the presence, in portland cement, of various compounds of lime with silica, alumina, iron oxide, etc., which hydrolyze more or less readily in aqueous solutions, liberating lime. Consequently, if aqueous solutions are used to dissolve the free lime from the cement as a procedure preliminary to the making of the test, it appears certain that the value obtained in the test will represent both the free lime in the cement and the lime liberated by hydrolysis due to the action of the solvent. Only the free lime present in the cement at the time the test is made, and not that which may be liberated during a test, is desired. A method which would determine only the free lime present in the cement at the time of the test would be of considerable value in studies on the constitution of cement, and also in the routine examination of commercial cements.

The terms "uncombined lime" or "free lime" refer specifically to CaO, together with such amounts of hydrated lime, $Ca(OH)_2$, as may be present. The proportion of $Ca(OH)_2$ present in normal portland cement is probably very small, and may be negligible under ordinary conditions.

The present investigations as carried on by William Lerch and R. H. Bogue of the National Bureau of Standards are not concerned with the question of volume constancy or "soundness." The general problem of "unsoundness" and the relation between this condition and the free lime content is reserved for future study.

The procedure recommended by the investigators is as follows:

One gram of freshly ground cement is weighed out, placed in a flask with 25 to 30 cc. of absolute alcohol, 5 to 6 cc. of glycerol, and 8 to 10 drops of indicator. The mixture is heated to boiling, and titrated while hot with the standard ammonium acetate solution. The operations of boiling and titrating are repeated until the pink color does not reappear on boiling for several minutes. If only a small amount of free CaO is present in the cement, the pink color may not appear until after several minutes boiling, but if no color appears in ten minutes the test may be considered negative.

The total time required for the completion of a test may vary from a few minutes to an hour or more, depending on the amount of free lime present, the fineness of grinding, and the amount of glass in the cement. In every case the boiling should be continued until such time that the pink color does not reappear for several minutes after the final addition of ammonium acetate.

The alcohol used may be pure anhydrous ethyl alcohol or anhydrous denatured alcohol Formula 3a, consisting of ethyl alcohol 95% and methanol 5%, or anhydrous denatured alcohol Formula 2b, consisting of ethyl alcohol 99.5% and benzol 0.5%. If the alcohol is not already neutral to phenolphthalein, it should be brought to this condition. Since absolute alcohol takes up water readily, it should be kept in a tightly-stoppered container. A freshly prepared product is preferable.

The glycerol used is the usual U. S. P. product, but as it is hygroscopic it must be carefully protected from the air.

The indicator is phenolphthalein prepared in the usual manner, 0.2 gram in 100 cc. of alcohol.

The only standard solution required is a solution of ammonium acetate. Since this salt is hygroscopic it is impossible to prepare a standard solution by weighing out the exact amount of salt. A solution of about 0.2 *N* is desirable. This solution is prepared by weighing out about 16 grams of reasonably dry ammonium acetate, dissolving in absolute alcohol, and making up to 1 liter by adding the necessary amount of absolute alcohol. The solution is then standardized by titrating against pure CaO. The latter should be prepared by calcining pure calcite in a platinum crucible at 900 deg. to 1000 deg. C., the heating to be continued until constant weight is obtained.

One-tenth gram of the freshly prepared CaO is placed in a flask with 25 cc. of alcohol, 5 cc. of glycerol, and 8 to 10 drops of phenolphthalein. The mixture is heated to boiling and titrated while hot with the ammonium acetate. If the CaO forms lumps on wetting, it may require reheating and titrating several times before all the lime enters into the reaction. The strength of the solution is then calculated in terms of grams CaO per cubic centimeter.

*Abstract from *Industrial and Engineering Chemistry*, 18, 7 (739-43).

Cement Stock Increase Shows Plant Expansions

Immediate Building Outlook More Favorable Than Long Time View — Public Improvements Needed

By William M. Kinney

General Manager, Portland Cement Association

(Reprinted from the New York Commercial of July 2, 1926)

THE present year has fallen somewhat behind 1925 in the use of portland cement, as gaged by shipments from the mills, according to reports of the U. S. Bureau of Mines covering the first five months of the year. Within that same period several new plants and extensions have come into production in addition to the very large increase in capacity made during 1925.

Combined stocks of finished cement and cement clinker (unground cement) at the end of May were 5,283,000 bbl. greater than a year ago, or nearly 20% more, although the monthly government reports on production show that manufacturers did not average more than about two-thirds of full capacity during the first five months of the year.

The summer months are the season when cement shipments normally attain a very high volume, because of the wide use made of this material in all sorts of construction work. In fact, cement is so universally used in some part of the structure and finds its way into the work so soon after it leaves the mill that shipments are an excellent measure of actual progress in construction.

The reliability of this indicator was shown by the notable movement of cement in May, which reached unusual figures only because the backward spring had held up work on a great many projects that all started with a rush when conditions became better.

What Authorities Say

Authorities declare that the industry this year will have a capacity of 200,000,000 bbl. of cement, a production that is nearly 30% in excess of the largest yearly demand so far enjoyed. With the plants now under construction thrown into production not later than 1927, the capacity will be raised to 210,000,000 bbl. or more, which is 35% greater than the demand in 1925, the country's banner building year, when 156,724,000 bbl. were shipped.

Because of a late spring, construction in 1926 so far has been only ordinary and behind the progress made during the same period of 1925. The situation has been general over most of the country. Road work has been slower than in previous years, generally speaking, because of unseasonable weather. Structural use of concrete has likewise suffered.

William M. Kinney

There is nevertheless a note of optimism regarding the remainder of the year, for contract awards have been exceeding those of 1925, the building industry's big year. In some localities which have been slow to feel the building boom of last year, awards are greater than in any past year. However, a let down is expected rather than the spurt that occurred last summer.

Paving Increases

From a cement standpoint, the awards for concrete pavements are especially gratifying. The growing public satisfaction with concrete paving is shown by the fact that from January 1, 1926, to June 1, 1926, a total of 47,616,000 sq. yd. of concrete pavement has been awarded. Street and alley paving awards are already 2,500,000 sq. yd. greater than one year ago. Actual construction of roads is being speeded to overcome the handicap of late spring. The south and middle western agricultural states are showing especial interest in concrete highways.

While road and street construction gives more promise of continuing at present high levels than does general building activity, this would not be sufficient to overcome a considerable slump in the latter field since paving takes but a fifth of all cement used.

There are indications of slight slackening in home building, although concrete products are still at a high level and have not receded from the mark set in 1925. Farm use of cement has been slowly increasing during the last two years. It can be said in this connection, however, that only a very small part of the farm dollar is going into construction as compared with the portion going into other expenditures.

Ahead in Heavy Structures

Heavy structures are somewhat ahead of last year in general, although in some classes of construction there is a lessening in volume. In public works, cement requirements as represented by awards are ahead of last year, but behind in actual construction. Railroads are using more cement and at least one system is planning the construction of a section of concrete slab track support to replace ballast and wooden tie construction.

Government bulletins show that at the end of May finished cement stocks stood at 21,157,000 bbl. as compared with stocks on hand of 18,440,000 bbl. in May, 1925. Cement clinker stocks were 11,619,000 bbl. this year as against 9,053,000 bbl. a year ago. Shipments for the first five months of 1926 were 51,942,000 bbl. as compared with 52,585,000 bbl. in 1925.

It would indeed be gratifying to all interested in construction to feel that building operations in the future could be maintained indefinitely at the present high rate. This can hardly be expected, however. While general business conditions present many favorable factors for the building trade, such as slight unemployment, easy money and a high volume of awards during the first part of the year, there are other factors not so favorable.

Balancing Necessary

Some authorities seem to feel that installment buying is being carried too far, that real estate has become top heavy at current values and that our unfavorable trade balance will eventually make itself felt in lessened prosperity. Others point out that building permits, which precede actual contracts by a considerable time, have been declining when allowance is made for seasonal movements. All of this involves the balancing of intangible or poorly measured factors, and the truth must be left for the future to disclose.

In any case, it is certain there is a vast number of wealth producing public improvements that are greatly needed, and that must be carried on in large volume if our country is to progress. Chief among these are road and street paving, and the widening of existing pavements to care for the still multiplying motor traffic.

Such improvements save their cost many times over in lessened operating expenses and traffic congestion, to say nothing of the millions in increased property values.

Recent Research in Fine Grinding

Summary of Investigations Conducted by the British Portland Cement Research Association Between 1923 and 1925

THE work done in this research establishes the right of grinding to rank as an exact mechanical science, with its own laws and methods of calculation, as definite as those appertaining to electricity and steam. In other words, just as the engineer knows the amount of electrical energy or steam necessary to perform a given amount of work under definite conditions, a development of this research in grinding would enable one to estimate the theoretical amount of work required to reduce a given material to a degree of fineness under given conditions. It will then be possible to deduce the efficiency of any grinding machine, just as today any engineer can deduce the efficiency of an electrical generator or a boiler.

The material experimented with in this research was pure quartz sand.

Editor's Note

THIS is an abstract of a report by Dr. Geoffrey Martin, recently director of research of the British Portland Cement Research Association, published in the June 4 issue of the Journal of the Society of Chemical Industry (London, England). In this report Dr. Martin emphasizes the need of more extended research of the whole problem of grinding, and details the difficulties overcome in this particular study, caused by the withdrawal of the financial support of the British government.

Laws of Grinding

Law 1. (Rittinger's law.) The surface produced is accurately proportional to the work done. Double the work done and the surface produced is doubled. Treble the work and the surface produced is trebled, etc.

This law was originally guessed at by von Rittinger in 1867, but was first proved rigorously between 1924 and 1925, when actual measurements of the surface of powdered quartz by a chemical method and of the horse-power required to powder it were made by the British Portland Cement Research Association. These results were obtained in a small experimental tube mill using 1-in. steel balls:

Work done	*Increase in sand surface*	*Work required to increase surface 1 sq. ft.*
ft.-lb.	*sq. ft.*	*ft.-lb.*
243,375	3,971	61.3
470,250	7,852	59.9
699,190	11,170	62.6
892,346	14,941	59.7
1,097,300	17,899	61.3

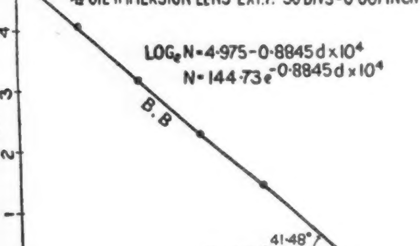


Fig. 1

The physical basis of Rittinger's law is the constant molecular attraction which holds together the particles composing any chemically pure, brittle crystalline substance. In dividing the crystals work is being done against a constant force. In the liquid state a similar law holds. The surface tension of a pure liquid is a constant. Hence, when a liquid film is extended (as in blowing a soap bubble) the work done is proportional to the surface produced.

Formula Derived

As the result of these experiments it is a simple matter to calculate the work required in grinding to any requisite degree of fineness with any given grinding media.

$W = B\ (S_2 - S_1)$ ft.-lb. ....(1)

S_2 = final surface of the powder in sq. ft.

S_1 = original surface of the powder in sq. ft.

B = a constant peculiar to the grinding medium employed, the material ground, and the type of grinding machine employed, being the work required to increase the surface by 1 sq. ft.

With the experimental equipment used—1-in. steel balls in the 18-in. mill for quartz sand, B was found to be 60.9 ft.-lb.

Formula Applied

Example—Calculate the power required to grind per hour 3 tons of quartz sand from a fineness represented by 24.3 sq. ft. per lb. to a fineness represented by 827 sq. ft. per lb. (corresponding to 1% on a 200-mesh sieve) using 1-in. steel balls in a 18x18-in. mill.

3 tons = 6720 lb. (English tons)

Final surface S_2 =

$6720 \times 827 = 5{,}558{,}000$ sq. ft.

Initial surface S_1 =

$6720 \times 24.3 = 163{,}300$ sq. ft.

Constant $B = 60.9$ ft.-lb.

Hence employing the formula (1)

$W = 60.9\ (5{,}558{,}000 - 163{,}000)$

$W = 328{,}600{,}000$ ft.-lb.

1 hp. = 33,000 ft.-lb. per min.

= 1,980,000 ft.-lb. per hr.

Theoretical hp. required to grind 3 tons of quartz sand per hour =

$$\frac{328{,}600{,}000}{1{,}980{,}000} = 166 \text{ hp.}$$

Must Have a Standard Medium

The grinding efficiency of various types of mills should be measured in terms of the work in ft.-lb. required to increase the surface of a standard quartz sand by 1 sq. ft.

[The method used to determine surface areas may be that described in detail in ROCK PRODUCTS, July 10, 1926, pp. 65-68 in the paper by Herbert F. Kriege, on the "Relation Between Fineness of Limestone and Its Rate of Solution," since there is a fixed relation between solubility and surface area exposed. This, we understand, was the method employed by Dr. Martin.—The Editor.]

At the present time the same types of machine give most discordant data on efficiencies; for example, in one cement works Dr. Martin found by actual measurement that one ton of cement per hour required the expenditure of 115 hp. to grind to 5% on a 180-mesh sieve, while in another he was assured by the engineer that only 35 hp. was required to perform this work, and in another case only 20 hp.

Mills of the same type or different types can not, therefore, be compared as to efficiency unless they are grinding identically the same material; but the grindability of different portland cement clinkers may be rated one with another, if all of them are compared with the grindability of standard quartz sand. Hence the efficiency of mills grinding cement clinker may be similarly determined.

Second Law of Grinding

Law 2. The number of particles produced increases with the decreasing diameter, according to the compound interest law.

Mathematically expressed this law is: In a given weight of finely crushed sand, if N be the number of particles of diameter x, and if N and x be considered as variables, then in every case so far tested:

$N = ae^{-bx}$ ....(2)

Where a and b are two constants character-

istic of the sample treated. Differentiating (by calculus) equation (2)

$$\frac{dN}{dx} = bae^{-bx} = -bN \qquad (3))$$

In other words, the rate of increase with decrease in the diameter in the number of particles of a given degree of fineness is proportional to the number already present of that particular degree of fineness.

Taking logarithms of (2):

$$\text{Log}_e\, N = \text{Log}_e\, a - bx$$

Plotting the logarithms of the numbers against the diameters gives a straight line (Fig. 1).

The physical significance of this is: Consider a set of sand particles A (Fig. 2). By grinding each of the particles A gives rise to the same number k (in Fig. 2 $k = 2$)

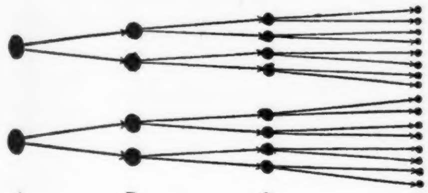


Fig. 2

of smaller particles B, which in their turn give rise each one to the same number k of still smaller particles C, and so on all the way down the scale, so far as the matter can be pursued by means of the microscope, with the ultimate production of colloidal particles.

The law is probably the expression of the fact that crystals have a definite and fixed structure, and consequently break up when subjected to percussion or pressure in a regular and definite manner which follows a definite mathematical law when the number of particles considered is sufficiently large to allow of the application of the law of probability. It is possibly a necessary consequence of Rittinger's law.

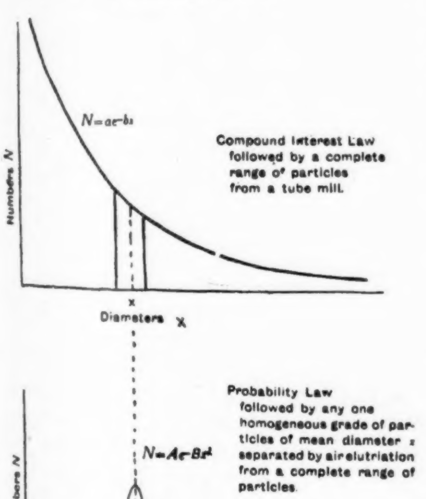


Fig. 3

Third Law of Grinding

Law 3. The average shape of the particles produced in crushing remains the same whether they are large or small.

This was proved by grading out the crushed quartz sand by elaborate air-elutriation experiments, and then proceeding to measure the absolute diameter, surface area, weight, and number of particles in each grade. The result was confirmed by plotting a graph against the diameters, the terminal speeds obtained when particles of sand of different diameters were allowed to fall in air at a constant temperature. Both the small and the large particles occurred on the same straight line, which would not have been the case if their shapes had differed.

The experiments showed that for sand particles ground in a tube mill and of arithmetical mean diameters ranging from 0.00333 c. to 0.01089 cm. this surface constant is about 2. In other words, if the arithmetical mean diameter of a particle be d cm., the arithmetical mean surface area will be 2 d^2 sq. cm.

Fourth Law of Grinding

Law 4. Any grade of crushed sand coming from a tube mill is composed of homogeneous grades of crushed sand, in which distribution of the numbers of the particles with their diameters can not be altered, no matter how often we regrade the sand.

These statically homogeneous grades of sand may be considered as the unalterable elements, which compose a given mixture of sand particles. In such an homogeneous grade the distribution of particles follows the probability law.

This was proved by separating out the sand coming from the tube mill (and whose particles followed the compound interest law $N = ae^{-bx}$) into separate grades by repeated air elutriation. One of these grades was elutriated some 8 or 9 times without in any way altering the distribution of particles therein, which was found to follow the probability law $N = ae^{-bx}$, where N is the number of particles of a given diameter x; a and b are constants.

This law is also probably a mathematical consequence of Rittinger's law and the compound interest law. The laws regulating particle size are thus established.

Wyoming Surveys Its Mineral Resources

A RECENT article by A. L. Bartlett, Wyoming state geologist, published in the Cheyenne *Tribune*, brings to light the extensive varieties of rock products abounding in the state.

The survey states that in coal resources Wyoming ranks first in the country, and in asbestos, bentonite, oil shale, potash, phosphates, iron, oil and natural gas, it is also among the leaders and probably contains more mineral resources combined than any other state. Other important resources include platinum, gold, copper, clay, cement materials, epsomite, granite, manganese, mica, sulphur, cyanite, feldspar, garnet, soda, graphite, gypsum, kaolinite, limestone, talc and tripoli.

The location and extent of some of the more important deposits are as follows:

Casper Mountain contains possibly the largest deposit of asbetsos in the United States. Two mills were erected several years ago.

Bentonite, a collodial clay resulting from a volcanic ash, is universally present in the oil districts of the state and is being produced at Medicine Bow, treated at Cheyenne and is shipped to all parts of the country.

For the manufacture of portland cement there are adjacent deposits of limestone and shale at Newcastle and at Iron Mountain, which are also on the railroad.

The Encampment district has several deposits of both mica and chlorite which sells as mica, and carload shipments have been made.

Platte county has some good sheet mica in the claims of Stein and Lank at Sunrise, and west of Wheatland a large dyke has a high content of mica and is being developed by the Mica Queen Mica Co. at Mica Hill.

A very high grade feldspar occurs in Wyoming, particularly in the pegmatite dyke, with the mica being developed by the Mica Queen Mining Co.

The phosphates resources of Wyoming are among the most important in America. They are located in the western and southwestern part of the state.

The Leucite Hills of Sweetwater county are capped by a tertiary lava flow known as leucite, contained 10% potash and 10% alumina, estimated to contain nearly 200,000,000 tons of each. The principal deposits are about four miles from the railroad near Superior, Wyo.

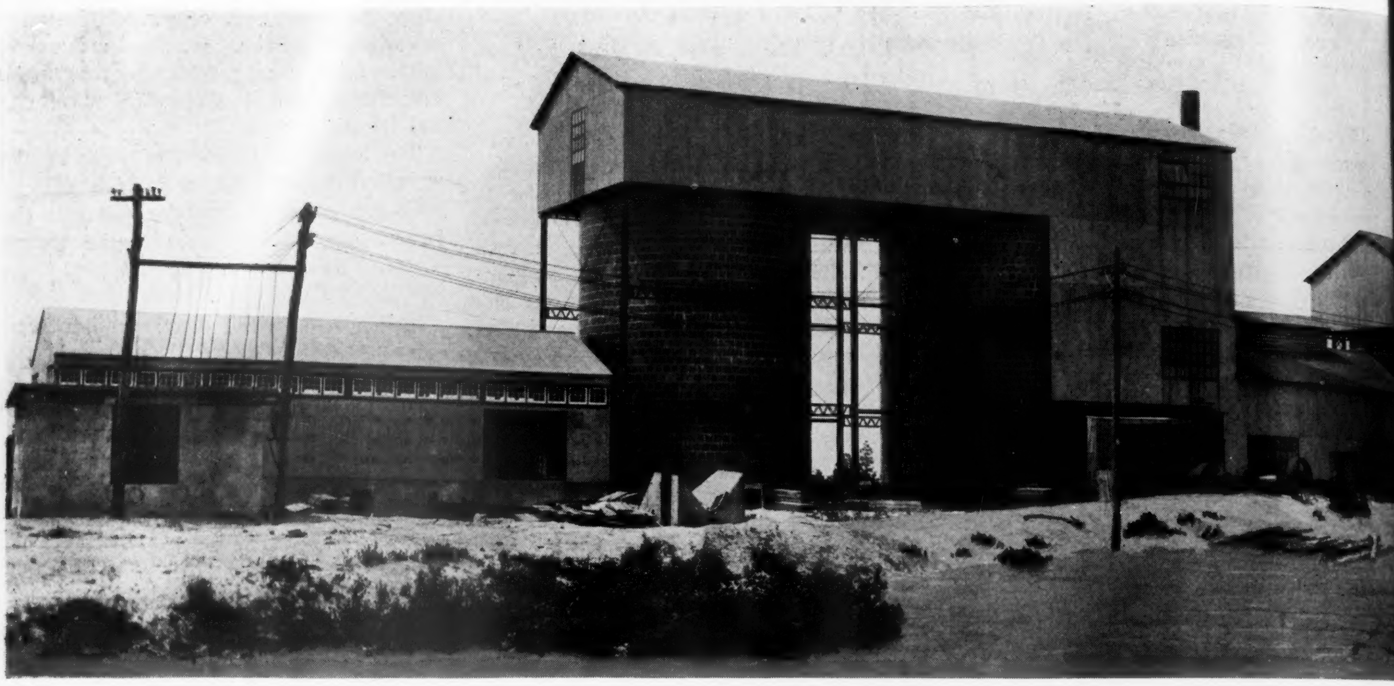
Graphite in commercial amounts occurs near Wheatland, southwest of Casper, and in the Encampment district.

Gypsum is plentiful in the Chugwater formation (Red Beds) in several parts of the state not far from the railroad. The manufacture of gypsum products is increasing in various parts of Wyoming as the local demand for this product develops and as these deposits are near the railroad they should soon become attractive. A gypsum plant in Big Horn is producing gypsum blocks for partitions and other indoor and outdoor construction.

The quarrying of limestone for sugar factory purposes has increased year after year, until now the shipments made amount to 60,000 tons per year, and as new factories are built shipments will become greater.

Talc has been discovered in the Cooney hills and in the Encampment district, and trial shipments have been made.

Tripoli occurs eight or ten miles north of Sunrise in the carboniferous formation. The deposit is of the Missouri type, slightly dark, and occurs in compact bedded layers.



Panoramic view of plant of Tavern Rock Sand Co., at Mill... J., show

Silica Sand Taken Out by Dredging

Newest Plant of Tavern Rock Sand Co. of St. Louis, Mo., Is Near Millville, N. J.

THE Tavern Rock Sand Co., of St. Louis, Mo., operates two silica plants in Missouri and one in New Jersey. The New Jersey plant, situated near Millville, which is to be described here, began production in the early part of 1925. The plant operations have since that time been changed so that it is somewhat unusual among silica plants, as it is a dredging operation, although not unique, as dredging has been applied to silica sand production in other places. But in general silica sand is obtained from sandstone deposits, some of which are so hard the rock has to be crushed and ground. The sand in this deposit is as loose as beach sand so the ordinary methods of sand and gravel production may be applied to it.

The company acquired rights to a large area of high quality silica sand. In testing the ground before the plant was constructed many samples were taken and analyzed and were found to run about 99.50% SiO_2. Some of the unwashed sand was made up into chemical glassware with excellent results. It is not pretended that the whole deposit will contain such a high silica percentage, but all of it will wash to an exceptionally pure sand for glass, silicate of soda, etc. The deposit contains also large amounts of sand suitable for molding purposes and some gravel.

The dredge used is 20x40 ft. and well constructed after the company's own ideas. It has a sturdy wooden hull on which is mounted a 6-in. Morris centrifugal pump driven by a 100-hp. Westinghouse variable speed a. c. motor. There is also mounted on the dredge a 3-in. Worthington centrifugal pump driven by a 5-hp. Westinghouse a. c. motor for priming the 6-in. pump, water seal and jetting which is used for breaking down the bank. The current for use in the plant and dredge is purchased from the Electric Co. of New Jersey, who have recently carried their high tension lines through the section.

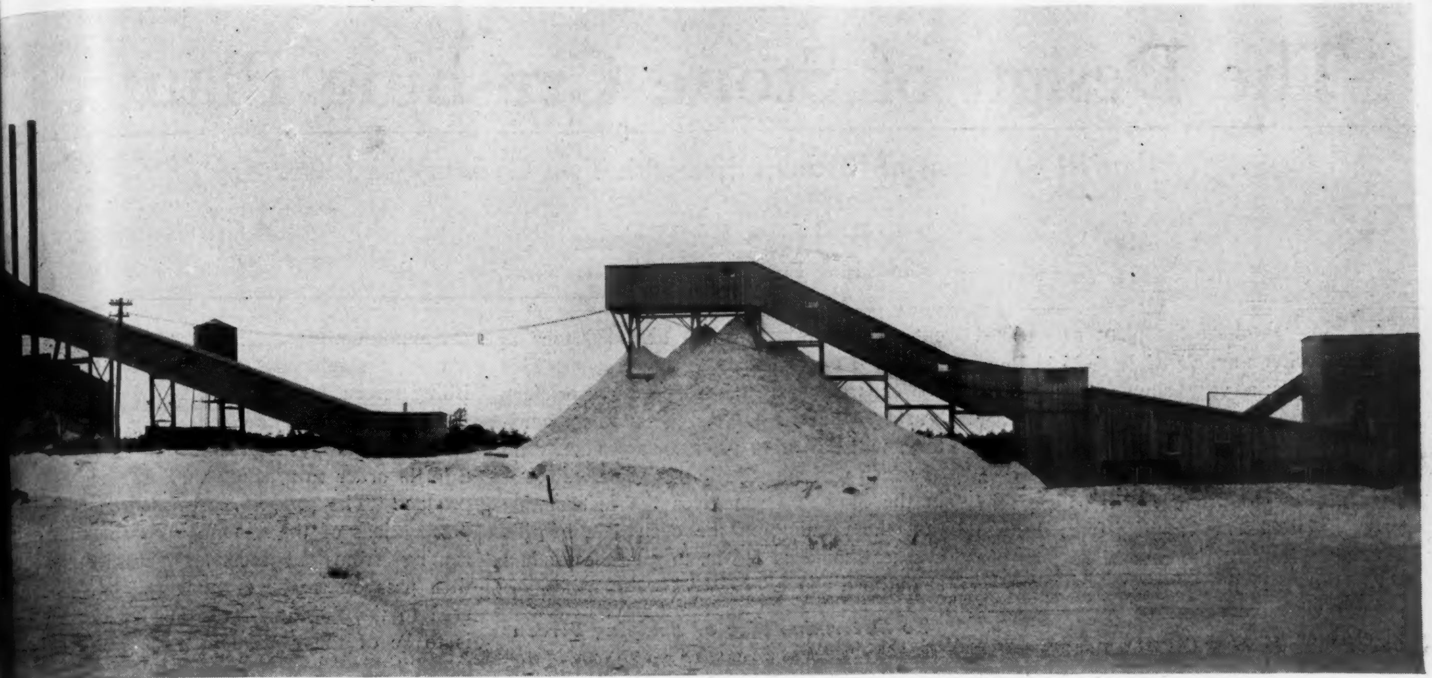
Ordinary Sand Practice Followed in Designing Plant

The pump delivers the sand and water through an 8-in. line to a washing plant on the bank and this is built more in accordance with sand and gravel practice than with silica sand practice. The material first goes to a revolving screen, where the oversize and trash are removed. Then it falls into a settling box and is removed by valves and troughs to Lewistown sand washers. There are eight sets of these Lewistown washer boxes which were originally grouped four washers to the unit, but were changed so that the operation would be more elastic. The present arrangement is such that the washer units can be varied on very short notice to groups of one, two, three or four washers to the unit, according to the service desired of them.

The washers are of the worm type, and the units are constructed so that one set can be taken out of operation without interfering with the second set. The washers are driven by a 20-hp. Westinghouse a. c. motor, and the sand from the washer boxes is discharged to a 22-in. conveyor belt taking the dewatered sand to a height of 40 ft., and then runs horizontally for a distance of 40 ft., where it is discharged to a drain pile.

The water used in washing the sand is pumped from a well and is absolutely clear water, the well having a Worthington "Axiflo" pump, driven by a 30-hp. General Electric a. c. motor, and produces 500 g.p.m.

The sand, when discharged by the conveyor belt from the washers, drops to a drain pile through which travels a concrete tunnel with openings in the top, and inside of the concrete tunnel is a 30-in. conveyor belt 500 ft. long furnished by the Goodyear Tire and Rubber Co. The sand is discharged after being partly air dried to the conveyor belt, where it is carried up to a hollow tile bin 30 ft. in diameter, 32 ft. high, the belt being operated by a 15-hp. Westinghouse a. c. motor. The sand is removed from the hollow tile silo previously mentioned by a reciprocating feeder, which discharges it to a 30-in. conveyor belt, and is lifted by a bucket elevator and discharged to a rotary



[illegible], J., showing progress of material, which comes in at right by pipe line

type dryer, designed and constructed after their own ideas, through which the sand passes and becomes perfectly dry when discharged at the other end. Oil is used for heat in removing the moisture from the sand, and the sand when dried discharges to a bucket elevator, where it passes over two Link-Belt vibrating screens, the oversize being discharged to hoppers, and the screened sand discharged to a conveyor belt, which, in turn, discharges to a bucket elevator, where it is spouted, or conveyed to the dry sand hollow tile bins.

Dry and Wet Storage in Tile Silos

The storage bins, or silos, are constructed of burnt clay tile of the same type as used for farm silos. Each row of tile has five hoops, which are grouted in with concrete, the wet sand silo being 30 ft. in diameter and 32 ft. high, and the dry sand silos being 30 ft. in diameter and 40 ft. high.

There are two 125-hp. boilers, purchased from E. Keeler and Co., Williamsport, Penn., formerly used for the furnishing of steam power to generate electricity, one of which is now used for steam to atomize the oil used in the dryer. The company contemplates installing an air compressor for this purpose, which will eliminate the use of the boilers, except during the winter months, when heating is necessary.

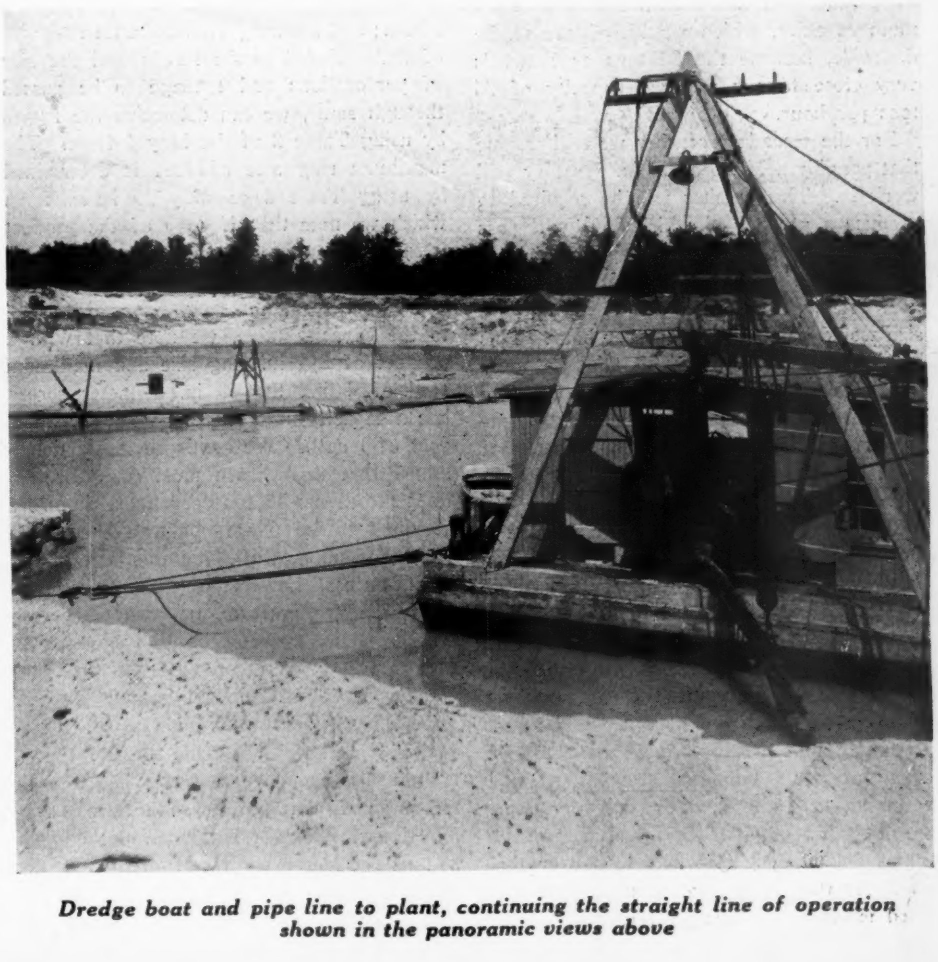
Plenty of Capacity to Meet Demand for Material

The pumping and washing plant has a productive capacity of from 40 to 50 tons per hour, and the drying plant a capacity of 30 tons per hour, and with the large storage bins for dry sand, and the almost unlimited storage space for damp sand, the company is in a good position from the standpoint of ability to meet demands for the material.

The washing plant is of wood construction, but the boiler house and mill are of concrete and steel frame, covered with corrugated galvanized iron.

In Business 37 Years

The Tavern Rock Sand Co. was organized in the state of Missouri, and has been doing business in the middle west for a period of 37 years. The New Jersey office of the company is at Bridgeton, about 12 miles from the plant. Lewis L. Stokes is manager. The operation of the plant is in charge of George H. Wheeler, superintendent. The Missouri plants of the company are at Pacific and Gray Summit, Mo.



Dredge boat and pipe line to plant, continuing the straight line of operation shown in the panoramic views above

The Design of Stone Crushing Plants

Part III—A Plant of Medium Size with Two Gyratory Crushers

By Hugo W. Weimer
Consulting Engineer, Milwaukee, Wis.

THE flow sheet of the plant as outlined in the writer's article of June 26 in ROCK PRODUCTS was a very simple arrangement requiring the simplest calculations in order to have the proper equipment listed.

We will now assume a problem for a crushing plant to produce various sizes of fairly hard limestone ranging from dust to 2½ in. ring size at the rate of 75 tons per hour. We will figure on using gyratory crushers with the necessary rotary screens and elevator.

By referring to the January 23 issue, "Table of Gyratory Crusher Sizes," we find that no single crusher can produce the desired capacity for a product such as we require, therefore it is obvious that two gyratory crushers must be used. A No. 7½ or 15 in. crusher is listed as having a capacity of 80 tons per hour at 3¼ in. ring size. This size is apparently satisfactory and the capacity is within our requirements, but as we will have another crusher following we can probably produce a slightly larger size of product and thus obtain a larger maximum capacity, which would, of course, be desirable, because the 80 tons as listed is very close to our required capacity of 75 tons per hour.

For the secondary crusher we will assume that possibly a No. 5 or 10 in. gyratory will work in. This crusher will be required to produce a product of which 85% will pass 2½ in. ring size. The 10 in. crusher is listed as having a capacity of 30 tons per hour at 2 in. ring size, which at 2½ in. ring size would be about 38 tons per hour. This crusher will be required to take not only the oversize from the first crusher, but also take care of the rejections from the finishing screen; therefore we must figure that the original feed should not be more than about 30 tons per hour.

This proposed plant which we now have determined is to consist of a primary gyratory crusher and a secondary gyratory crusher should be equipped with a scalping screen located between the two crushers so that the secondary crusher will not be overloaded and will be required to work only on that product which is not of a finished size. Assuming that the 15 in. crusher would be set to produce 3½ in. ring size product, and referring to Table 2 in the May 29 issue, we find that 60% of the product will be minus 2½ in. ring size and 40% over this size. As this is our maximum size of finished product, a scalping screen would take out 45 tons, which would leave 30 tons to be passed on to the secondary crusher. This is satisfactory, therefore the primary crusher, which is a No. 7½ or 15 in. gyratory, will be set to produce a product 85% of which will pass 3½ in. ring size. Table 1 in the May 29 issue gives the information that the opening on the open side of this crusher should be 2½ in. to give the product as outlined above.

To Determine Size of Scalping Screen

Following the primary crusher will be the scalping screen, and the first thing to do is to determine the required diameter, which, of course, is based on the tonnage per hour. Table 1 in the May 1 issue gives us this information and we find that a 48 in. diameter is listed as having an average capacity of 85 tons per hour. This figure, however, is too close to our required tonnage, and as screening equipment in particular should be figured liberally we will take the next size or 60 in. diameter. Next we will have to determine the length of this scalping screen; and knowing the maximum ring size of material fed to the screen and the size of perforations and tonnage to be passed through same, we can determine the length by using Table 2 of the May 1 issue. The maximum ring size of feed is determined by using Table 2 of May 29 issue, from which we note that if 85% of the product is 3½ in. ring size, the maximum piece that would pass through the crusher would be approximately 4 in. ring size. Referring to the capacity table, we note that with a product of 2½ in. ring size and maximum feed of 4 in., the 60 in. diameter screen has a capacity of 6 tons per hour per lineal foot of length. We have previously determined that this screen must pass through its perforations 45 tons per hour, therefore dividing 45 by 6 we obtain a theoretical length of about 8 ft. for this screen. It would be best, however, to make this screen 10 ft. long, therefore our scalping screen will be 60 in. diameter by 10 ft. long having perforations to produce 2½ in. ring size product, and Table 1 in the May 29 issue gives the information that the round perforations should be 3 in. in size.

For the secondary crusher, which is a No. 5 or 10 in. gyratory, we have determined that it has a maximum capacity of 38 tons per hour when set to produce 2½ in. product. Since only 30 tons is the original feed the difference between this figure and the maximum capacity will undoubtedly take care of the returning oversize from the finishing screen. From Table 1 in the May 29 issue we find that the opening on the open side of this gyratory crusher should be 2 in. in order to produce a 2½ in. ring size product. The product passing through the perforations of the scalping screen and that coming from the secondary crusher will then pass on to the elevator and be delivered to the finishing screen. This elevator is to be of the continuous steel bucket inclined belt type, and from Table 4 of the May 29 issue we find that a 16 in. bucket elevator is listed as having a capacity of 90 tons per hour, and this is satisfactory for our requirements.

For the finishing screen we will again decide to use a 60 in. diameter because we know it will have the required capacity; and another important feature is to have this screen a duplicate of the scalping screen as far as the diameter is concerned, thus making it necessary to keep only one set of spare parts on hand for repair purposes. Too often this feature is neglected when designing a plant, and at a later date the operator regrets the fact that duplicate equipment was not used when it was possible to do so.

Having determined the diameter of the finishing screen, we must know what sizes of finished product we require and also what percentages of these sizes are produced by each of the crushers. We will assume that four finished sizes of product are required besides the dust, and these will range from 2½ to 2, 2 to 1¼, 1¼ to ¾, ¾ to ¼ in. and minus ¼ in. which is the dust. The first finished product is produced in the primary crusher and is the material which passes through the perforations of the scalping screen. Assuming that this crusher is set to produce a product 85% of which will pass 3½ in. ring size, and using Table 2 of the May 29 issue, we find that the percentages and tonnages of the various sizes of product would be as shown in Table I.

TABLE I.
15-IN. GYRATORY CRUSHER PRODUCT

Size inches	Percentage	Tons
+2½	40	30
−2½+2	13	10
−2 +1¼	19	14
−1¼+ ¾	12	9
− ¾+ ¼	13	10
− ¼	3	2
Total	100	75

Of the original feed 40% or 30 tons per hour is passed on to the secondary crusher,

and the balance, or 45 tons per hour, is passed on to the elevator and finishing screen. The product of the secondary crusher when set to produce 85% through 2½ in. ring size, using the table same as used for the larger crusher, would be as given in Table II.

TABLE II.
10-IN. GYRATORY CRUSHER PRODUCT

Size inches	Percentage	Tons
+2½	15	5
—2½+2	18	5
—2 +1¼	26	8
—1¼+ ¾	18	5
— ¾+ ¼	16	5
—¼	7	2
Total	100	30

The reader will note that 15% or 5 tons is oversize and this constitutes the circulating load which must be taken care of by the elevator, the finishing screen and the secondary crusher. Thus the elevator and screen must be able to take care of 80 tons per hour and the secondary crusher 30 tons of original feed plus 5 tons of circulating load, making a total of 35 tons per hour. We can safely assume that the 5 tons of circulating load when returned to the secondary crusher is all crushed to minus 2½ in. ring size. The percentages of the various sizes as made by the second break would be in fractions of a ton for some sizes, therefore we can estimate that of the total of 5 tons we would produce one ton of each of the five finished sizes. It is necessary that we assume some figures so that we will obtain our total tonnage of 75 tons at the bins.

We have established the finishing screen as 60 in. diameter and now require the length for the various sections. To take out the dust we will figure on using an outer jacket on the screen. By adding together the tonnages of the various sizes as produced by each crusher we obtain the total of each size of finished product and with this information, together with the rotary screen capacity as given in Table 2 in the May 1 issue and Table 2 of the June 26 issue, we can obtain the theoretical length required for each section. This information is tabulated in Table III, giving also the practical length that should be used.

Must Figure Liberally

The reader will note that a 60 in. diameter screen with 19 ft. length and with a 6-ft. dust jacket would be required. Again we have been liberal in figuring the length of the first section of the main drum and also the dust jacket. This is very necessary, because in actual operation more fines are produced than indicated in the theoretical calculations. All sections in the main drum should be made of perforated steel plate ¼ in. thick, and as to the size of round perforations necessary we will refer to Table 1 of the May 29 issue, and we find that for ¾ in., 1¼ in., 2 in. and 2½ in. ring sizes of product we should have ⅞ in., 1½ in., 2½ in. and 3 in. round perforations respectively. The dust jacket should preferably be made of double crimped steel wire cloth having 5/16 in. or ⅜ in. clear openings. Rotary screens are not particularly efficient for fine screening and therefore in most cases the larger opening for the dust jacket would be preferable.

The principal equipment for this proposed plant would therefore consist of the following:

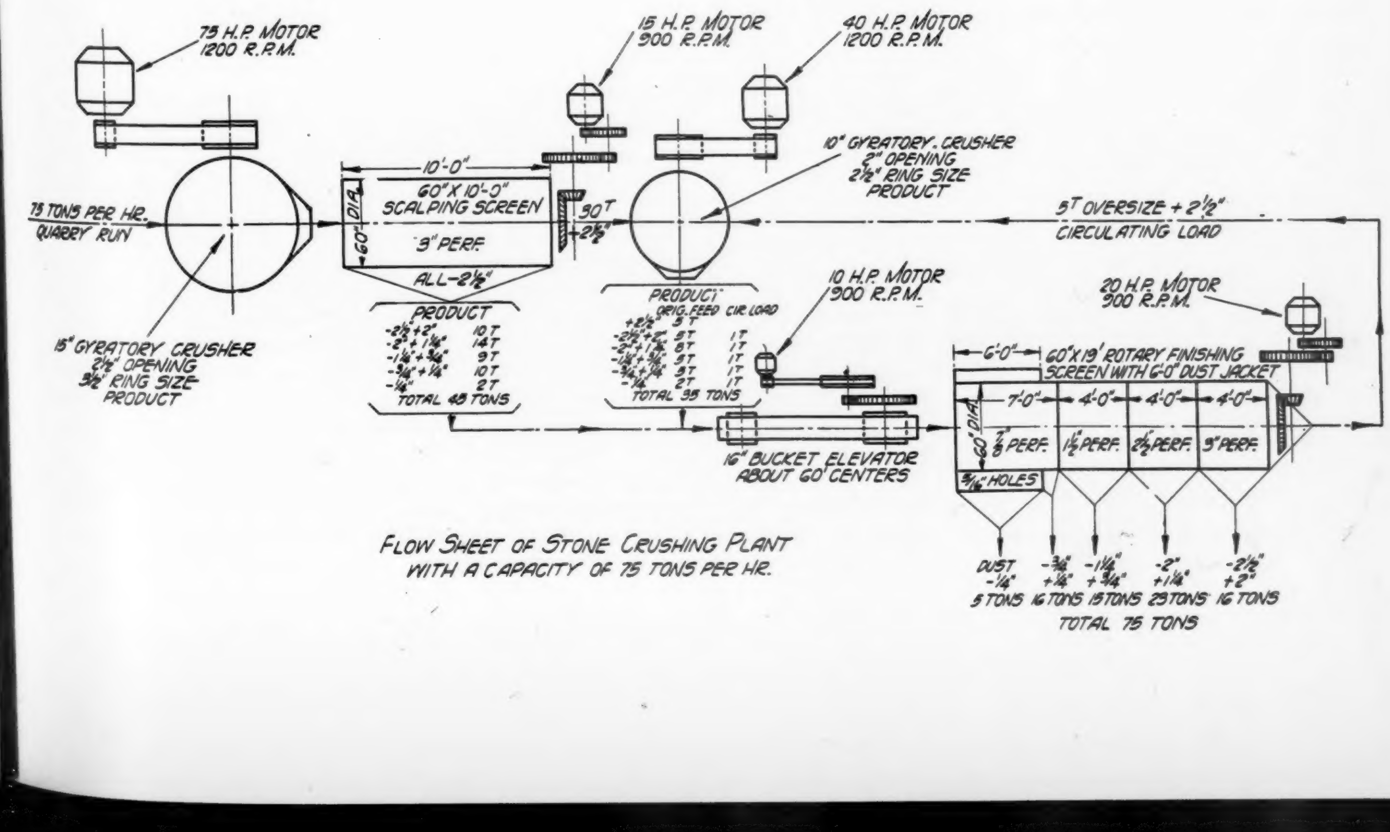
One No. 7½ or 15 in. gyratory crusher.
One No. 5 or 10 in. gyratory crusher.
One 60 in. by 10 ft. scalping screen.
One 16 in. continuous steel bucket elevator, inclined belt type, about 60 ft. centers.
One 60 in. by 19 ft. rotary finishing screen with 6 ft. dust jacket.

Having determined the principal equipment, we can now discusss the matter of driving the various units. Assuming that electric power is available, the writer would recommend that individual drives be used. There is no question but for a plant of this type and size there is economy in having an individual motor for each machine. For the gyratory crusher we could belt direct from the motor pulley. The speeds of the crusher drive pulleys are such that no difficulty will be experienced in belting direct to a 1200 r.p.m. motor. The sizes of motors required can be determined from the gyratory crusher table given in the January 23 issue. It must be remembered, however, that while a gyratory crusher requires a certain amount of power even to run idle, the greatest amount of power required is determined by the work to be performed, and roughly speaking, machines of this type require from ½ to 1 hp. per ton of material crushed per hour. This varies with the ratio of reduction and also the hardness of the material. Assuming that we are crushing fairly hard limestone, a 75 hp. motor for the primary and a 40 hp. motor for the secondary crusher would be entirely satisfactory.

The two rotary screens, which we will assume would be of the bevel gear driven type, could be direct connected to a speed reducer which in turn would be connected to the motor. Another method would be as shown on the flow sheet, which consists of

TABLE III.—60-IN. FINISHING SCREEN DATA—LENGTH OF SECTIONS REQUIRED

Maximum ring size of feed inches	Size of product inches	Total tonnage required tons	Listed capacity per foot of length tons	Theoretical length of sections required feet	Practical length of each section feet
¾	¼	5	1.9	2.7	6
3	¾	16	3.1	5.2	7
3	1¼	15	4.6	3.2	4
3	2	23	6.2	3.7	4
3	2½	16	7.1	2.3	4



FLOW SHEET OF STONE CRUSHING PLANT WITH A CAPACITY OF 75 TONS PER HR.

a double reduction spur gear drive. Either one of these methods is permissible and would give satisfactory service.

For the power required for the screens we will refer to Table 1 of the May 1 issue, and we find that a 60 in. diameter screen requires approximately 1 hp. per foot of length. For the scalping screen, therefore, the writer would recommend a 15 hp. motor and for the finishing screen a 20 hp. motor. These motors if geared as shown on the flow sheet could be run at 900 r.p.m., which is a fairly high speed motor. For the elevator we find that by referring to Table 4 of May 29 issue we will require a trifle more than 7 hp., which would mean that a 10 hp. motor should be used. For this drive we could belt direct from a 900 r.p.m. motor to the elevator counter shaft. The motors required for this plant would then be as follows:

One 75 hp. 1200 r.p.m. motor for primary crusher.

One 40 hp. 1200 r.p.m. motor for secondary crusher.

One 15 hp. 900 r.p.m. motor for scalping screen.

One 10 hp. 900 r.p.m. motor for elevator.

One 20 hp. 900 r.p.m. motor for finishing screen.

This imaginary plant is of course merely a medium size plant and we have assumed that the rock in the quarry will be produced of a size suitable for a primary crusher that would be most economical for the capacity required. In this case the primary crusher has an opening 15 in. wide and necessarily all stone should be broken to a size not exceeding 75% of the opening or 12 in., which would allow of proper feeding to the crusher.

The matter of primary crushers for steam shovel operation and large plants is really a separate study and will be taken up in future articles.

Units Must Be Properly Balanced

It is most important for plants of any size to have the various units properly balanced, and that was the writer's idea in discussing this apparently simple plant in detail. Where two crushers are installed in a plant it is very necessary that the discharge openings of each be of such a size that each crusher will take its proportion of the entire load. It is very noticeable in some plants that this feature has not been taken care of. As this plant is outlined theoretically the reader will note that each of the crushers is calculated to do about the same percentage of its maximum capacity, which of course is an ideal condition and seldom attained in actual practice. Having the crushers properly balanced, together with screens and elevator of sufficient size, will allow of obtaining the maximum capacity from any plant, and it naturally follows that the cost per ton for operation would be at the minimum figure.

The German Market for Phosphate Rock

HIGH trans-Atlantic freight rates and comparatively low wages paid North African labor are operating against American sales of phosphate rock on the German market, Algerian and Moroccan competition continually gaining ground. It is estimated that current freight rates from North Africa are about 50% of the corresponding cost of haul from Florida.

Official import figures covering the first three months of 1926 show a marked drop in receipts of phosphate rock from the United States. They amounted to only 38,000 metric tons—or 37% of total imports of 102,000 tons—compared with 217,000 tons in 1925, or 54% of total imports (399,000 tons); 214,000 tons in 1924, or 78% of total imports (271,000 tons); 189,000 tons in 1923, or 86% of total imports (218,841 tons). In 1913, Germany imported the record total of 929,600 tons, of which the United States furnished 421,200 tons, or 45%.

Before the World War, Algiers was a considerable factor on the German market and supplied 191,000 tons, or about 20% of total imports. Until 1925, however, it was a comparatively unimportant competitor against American suppliers. In 1925, Algiers furnished 66,000 tons to Germany, or approximately 17% of the total receipts, and in the first three months of 1926, 20,000 tons, or 20% of the total.

Similarly, French Morocco, unrecorded in Germany's foreign trade statistics until 1925, is given as the country of origin of 50,000 tons, or 13% of the total in that year, and in the first three months of 1926, of 16,000 tons, which is 15% of the total. Tunis follows, with a decline in sales from 108,000 tons, or 11% of Germany's total imports in 1913, to 7,000 tons in 1925 (2%).

Current competition on the German market with phosphate rock is confined chiefly between the United States, Algiers and Morocco, with the two latter gaining in prestige. The next appreciable supplier according to current official figures in Belgium, with 13,000 tons registered in the first quarter of 1926.

The value of total 1924 imports of rock phosphate by Germany was 11,740,000 marks; 1925, 16,693,000 marks; and 1926 (first quarter), 2,690,000 marks.

"Phosphate-Gesellschaft" (Phosphate Co.) of Hamburg is the purchasing agent for the three or four score superphosphate plants in Germany. Phosphate-Gesellschaft takes bids on the open market, and covers demand at its own discretion.

Decline in German Superphosphate Trade

The extent to which superphosphate business has fallen off in Germany may be judged from the fact that although this country had net exports—excess of exports over imports—of 229,000 tons in 1913, corresponding net exports were only 4,000 tons in 1924, 6,000 tons in 1925, and but 15,000 tons in the first three months of 1926. Germany exports superphosphate to neighboring European countries, selling negligible amounts overseas.

Germany consumes considerably more phosphorus in agriculture than is represented by the imports of phosphate rock. The chief form in which it is consumed is basic phosphate slag, by-product of the steel mills. Germany is, doubtless, capable of producing around 1,000,000 tons of basic phosphate slag annually, which is less than half of the prewar output. Although Germany exported basic phosphate slag before the World War (273,000 tons in excess of imports in 1913), it has imported large amounts since. In 1925 Germany imported about 628,000 tons in excess of exports, chiefly from its former territories, such as Alsace-Lorraine, the Saar and Luxemburg. In the first three months of 1926, imports of basic slag were 161,000 tons, while exports were 12,000 tons.

During the war and shortly thereafter the Rhenania Co. of Aachen developed a phosphate fertilizer called "Rhenania Phosphate" and set up two plants to manufacture it. They were located at Brunsbuettelkoog in Holstein and at Porz near Cologne and had a combined capacity of about 150,000 tons annually. Unable to compete, however, they were closed down in 1924.

Although self-sufficient and an exporter of potash and of fixed nitrogen, Germany is and will continue to be an importer of phosphoric acid fertilizers.—Trade Commissioner W. T. Daugherty, Berlin in *U. S. Commerce Reports.*

New California Lime Plant Begins Operation

THE Sierra Lime and Minerals Co. lime kilns, recently built under the supervision of A. F. Graut of Sacramento, Calif., were put into operation at Diamond Springs (El Dorado county) the last week in June.

Crude oil is the fuel used and burners. The first units constructed comprise two modern kilns built of sheet and structural steel and fire brick, each some 50 ft. in height, with a 24 hour daily capacity of some 40 tons of finished product. The kilns will be kept in continuous operation by working three eight-hour shifts of men.

Crude limestone is hoisted by an electrically operated friction hoist and skip to the kiln top and automatically dumped. In starting the kilns are charged with seasoned oak wood, then filled with limestone and after the initial heating only crude fuel oil is used.

Bert Fiske of Sacramento with a fleet of trucks is hauling the crude limestone from the company's large quarries some five miles distant.

Manufacture of Lime From Small Stone With Sintering Machine

Report of the U. S. Bureau of Mines' Experiments with Dwight and Lloyd Machine, Described in Rock Products of July 10, 1926

By W. M. Myers
Associate Mineral Technologist, Bureau of Mines, Department of Commerce, New Brunswick, N. J.

UTILIZATION of small stone is recognized as one of the important problems of the lime industry. The term "small stone" is used to designate material that is too small for calcination in the shaft kiln. The maximum dimension of such stone may be placed at 4 in. The introduction of any considerable quantity of stone having dimensions less than this into the charge of a shaft kiln impedes the draft and renders successful operation of the kiln difficult or impossible. Attempts to design a shaft kiln which would calcine small stone satisfactorily have not been successful to date. Thousands of tons of this small stone are produced daily, and while part of it finds a market, for it has many uses, the profit is usually small, as competition is keen and prices are low. Production of the material is, however, so greatly in excess of market demands that a surplus of hundreds or possibly thousands of tons are placed daily in stock piles and classified as waste.

In a few instances a fortunate combination of circumstances, such as a program of highway or other construction work requiring large quantities of concrete aggregate, may make it possible for some quarries to market this stone later at a profit, but in general the chances of profitable utilization are slight, and the quarry operator has the expense of handling this waste stone and providing a storage site for it. The brittle nature of limestone makes it impossible to quarry the stone and crush it to size suitable for the shaft kilns without producing an excess of undesirable fines. Elimination of fines by changes in quarrying or crushing practices cannot be expected. On the contrary, the adoption of more modern methods of quarrying in recent years has increased the proportion of small material. The tendency is to blast the rock with large charges of explosives and crush it with mechanical crushers, which unavoidably produces more fines than the older methods of careful blasting with small charges and sledging the rock by hand. The increasing use of underground mining of limestone has also increased the production of small stone, as blasting in the confined space of an underground stope shatters the rock more completely than quarrying in the open. The use of the very friable limestones, such as the limestones of Florida, for the manufacture of lime adds a new factor to the calcination of small stone. These friable limestones have a low tensile strength and crumble in the kiln, causing trouble. Successful calcination of these stones is accomplished in specially designed short kilns. It is evident that the problem of the disposal of small stone will be of increasing importance, and that any method by which such stone can be economically converted into lime will be of great service to the lime industry.

Difficulty of Calcining Small Stone

In theory the calcination of small stone seems to be very simple. It is only necessary to heat the stone to a point where calcium carbonate, and any magnesium carbonate present, will dissociate into calcium oxide and magnesium oxide, with an evolution of carbon dioxide, and to maintain this temperature until the reaction is complete, leaving lime. The temperatures required are not excessive. Many limestones will begin to break down apparently when heated to 600 deg. C. As the temperature is increased the rate of reaction is greatly increased. The temperature in the average lime kiln will generally vary between 1050 deg. and 1250 deg. C., depending on the cehmical composition and physical properties of the stone and the type of fuel employed. Metallurgically such temperatures are neither very high nor difficult to obtain.

Present Method of Calcining Small Stone

In actual practice, however, the calcination of small stone presents many difficulties. The introduction of small stone in any type of ordinary shaft kiln, as already stated, blocks the draft so that continued operation is impossible. The carbon dioxide evolved from the stone and from the combustion of the fuel must be continuously removed, or a partial pressure will develop in the kiln which will prevent further reaction. To be successful any device utilized for the calcination of small stone must handle the material in commercial tonnages, and produce lime with a fuel consumption comparable to average kiln operation.

The only successful commercial method for the calcination of small stone at the present time is by use of the rotary kiln. This type of kiln is being used satisfactorily to calcine limestone varying in size from dust to 2½ in. The ease with which the process of calcination may be controlled, together with the fact that it is the only equipment which will calcine small stone, has recommended the rotary kiln to the lime industry. The principal objections which have prevented its more general use are the initial cost and the comparatively low fuel economy.

Study of the Sintering Machine as a Means of Lime Burning

While investigating the possibilities of other methods for the calcination of small stone, the Bureau of Mines cooperated with the Dwight and Lloyd Metallurgical Co., Inc., in a series of tests which were made in order to determine the possibility of using a sintering machine for calcining small stone. The results which were attained are summarized in this preliminary report. The experimental tests were made at the plant of the company at Netcong, N. J.

Construction and Operation of the Sintering Machine

The Dwight-Lloyd sintering machine was designed primarily for the sintering of fine ores into coherent masses which could be smelted in the blast furnace. [A detailed description of this machine was published on pp. 75-77 of the July 10 issue of Rock Products.—Editor.] The machine is entirely of metal construction, and has a series of traveling cars, called pallets, provided with grate bars in their floor. The grate bars have herringbone slots or pin-hole perforations, and are made of malleable iron, which has been found to be most serviceable. The frame of the pallet is made of cast iron. The pallets travel in an endless track; the arrangement is somewhat like an endless chain grate in which the sprocket chains would be replaced with grooved tracks in which the grate sections could move freely on rollers. By means of a drive gear the loaded pallets are propelled along a level section of track passing above a wind box, which is exhausted by an exterior fan.

A water gauge in the pipe leading to the fan indicates the partial vacuum produced in the wind box. The joint between the pallets and the wind box is fairly tight, so that when the machine is in operation all air exhausted by the fan must pass down through the grates, and therefore down through the charge of ore in the pallets. At the discharge end of the machine the pallets pass downward around a semicircular section of the track and thereby dump their load, then the empty pallets in reversed position roll by gravity above an inclined section of the track until they are picked up by the driving mechanism again. If the entire circuit of the machine is filled with pallets, it practically becomes an endless conveyor.

Ordinary practice in sintering ores consists of mixing the fine ore with a certain percentage, 6% to 10%, of solid fuel—either coal or coke screenings. This mixture is conveyed to a hopper and discharged as a thin bed on the pallets. As the driving sprockets revolve the charged pallets are advanced along the track until they pass beneath an ignition chamber at the head of the wind box. The ignition flame may be of gas, oil or powdered coal. As the pallets pass beneath this flame the fuel in the charge is ignited and continues to burn, through the action of the air drawn through the charge by the exhauster. The combustion raises the constituents of the charge to the temperature of incipient fusion, thereby forming a bond which unites the charge in a coherent mass suitable for the blast furnace. The rate of travel of the pallets, the percentage of fuel in the charge, and the velocity of the air blast are so regulated that the fuel is completely burned and a satisfactory sinter produced. Due to escaping gases, the structure of the sinter is porous, which facilitates its reduction in the furnace. When sulphide ores are sintered, addition of solid fuel to the charge is not necessary, as the combustion of the sulphides, which is started by the ignition flame and continued by the draft through the bed, supplies enough heat for sintering. The removal of moisture, sulphur and other volatile constituents during sintering increases the metallic content of the sinter, so that the sintering process is also one of concentration. In commercial use all handling of the ore and sinter is done mechanically, and the process requires little supervision. The machine itself can be operated with very little power. The power requirements of the fan are somewhat higher and the principal operating expense is in this form, and in repairs made necessary by the destructive action of the sulphur gases on the metal parts. It was to determine the feasibility of burning fine limestone on this apparatus by a procedure somewhat similar to sintering ores that the investigation described below was undertaken.

Small Scale Calcination Tests

A number of experimental runs were made on a small laboratory machine having pallets 12 in. wide by 4 in. deep. The wind box was 4 ft. long. In most tests a 60-lb. charge of limestone was used. The limestone was treated by three different methods, as follows:

No. 1. The limestone was mixed with solid fuel and ignited, calcination being entirely dependent upon the internal combustion in the charge.

No. 2. A low reverberatory arch was placed over the pallets, forming as close a joint as would still permit movement of the pallets. The space beneath this arch was heated with the flame of kerosene burners, the hot gases being drawn through the charge by a low vacuum in the wind box. The rate of travel of the pallets was adjusted to keep heat losses as low as possible with this equipment, and coal raw stone was constantly advanced into the firing zone at such a rate that the exhaust gases were kept at comparatively low temperatures. The partial vacuum in the wind box drew off the carbon dioxide as fast as it was liberated by the dissociating limestone, thereby keeping the partial pressure of the carbon dioxide extremely low, increasing the speed of dissociation, and preventing any possible reversal of the reaction ($CaCO_3 \rightleftarrows CaO + CO_2$).

No. 3. This method was a combination of *No. 1* and *No. 2.* A small percentage of solid fuel was mixed with the limestone and ignited as in *No. 1.* This heated the charge thoroughly. Before the charge could cool it was advanced by the travel of the machine to a point beneath the reverberatory arch, where calcination was completed by the hot gases from the flame of the oil burner.

Use of Grate Dressing

It was noted in the first runs that the stone in contact with the metal pallets or grate bars could not be calcined without excessive heating over a time sufficient to overburn the rest of the charge. The conductivity and chilling action of the metal was such that when the central portion of the charge was correctly burned, the stone on the sides and bottom was still nearly unchanged. This was remedied by constructing above the machine a hopper that charged a layer of previously burned lime into the pallets at the sides and bottom of the charge, as a grate dressing, so that none of the raw stone was in contact with the metal. This layer of grate dressing eliminated all trouble from the chilling action of metal contacts and permitted complete and uniform calcination. Similarly, other hoppers were so placed that layers of different sizes of stone could be charged one above the other in the pallets, because it was found desirable to charge the finer stone beneath and the coarser above. The coarser stone thereby received more heat and calcined at approximately the same rate as the finer stone beneath.

Type of Limestone Used for Tests

The limestone used in most of the experimental work was a high calcium stone from the underground mine of the American Lime and Stone Co. of Bellefonte, Penn. This stone possesses a very high calcium content and is of exceptional purity and uniformity. It was particularly adapted for this experimental work, as both the stone and the lime made from it were dense and of such strength that there was very little tendency to crumble. The stone also breaks in fairly cubical pieces with a minimum of flat flakes so that by screening it was possible to prepare charges of uniform dimensions. The raw stone is of a dark gray color, probably due to the presence of a small amount of organic matter. The lime is very white, and as the gray color of the stone does not disappear until calcination is complete, its presence acts as a very simple but valuable indicator of the completeness of calcination. Poorly burned stone when broken displayed a shell of white lime around a gray core of raw stone, the line of contact being very distinct and well defined. In some gray limestones from other sources the color bleached out as the stone was heated, and difficulty was experienced in determing by visual inspection the amount of calcination. A typical analysis of the Bellefonte stone is as follows:

Silica (SiO_2)	.80
Iron and alumina oxides (R_2O_3)	.40
Calcium carbonate ($CaCo_3$)	97.70
Magnesium carbonate ($MgCO_3$)	1.00
	99.90

This is not an easy stone to calcine, for its dense structure and high calcium content require high temperatures and a fairly long period of calcination. Therefore, it might reasonably be expected that any results obtained with this stone could be duplicated with most other commercial limestones, and probably could be excelled with some dolomites and low magnesium limestones which calcine readily at moderate temperatures. A few tests were also run using a dolomite from Pennsylvania, and a local high-calcium stone, and a dolomite from northern New Jersey.

Tests with Process No. 1—Calcination by Fuel Mixed with the Stone

Bellefonte stone having the following screen analysis was used:

Mesh	% Weight
4	0.0
8	7.0
10	16.0
20	25.0
35	20.1
65	14.5
+100	5.9
—100	11.5
	100.0

The stone was mixed with 10% of its weight of minus 8-mesh anthracite screenings. The charge was moistened during mixing. This is essential, as it causes the fuel to adhere to the stone and prevents segregation and loss during handling. The mixture of stone and fuel was placed on the pallets, and was ignited as they travelled beneath the ignition chamber. It was found that the time of heating required to calcine most of the limestone was not long enough to insure calcination of the larger pieces. Increasing the amount of fuel produced an undesirable quantity of ashes which tended to slag with the lime, producing an impure product and

causing loss of lime which was combined with the ash. Sizing tests of the charge after calcination showed that there had been a large loss of the very fine material, particularly that finer than 100-mesh. This had been drawn out of the charge by the strong down draft induced by the wind box. With stone that would all pass an 8-mesh sieve, it was possible to obtain quite successful calcination provided fuel was present in the ratio of at least one pound of coal for 10 lb. of limestone. The average results of the tests made with this process indicate that the necessary percentage of fuel produces too much ash with attendant contamination, and that the process is not under sufficient control for commercial use. Also it is limited to very fine stone.

Tests with Process No. 2. Calcination by Heat from an External Source

Stone similar to that used in Process No. 1 was charged directly on the pallets without the addition of any solid fuel. A temporary metal reverberatory arch, insulated with asbestos, was placed above the pallets directly over the wind-box. The space beneath this arch was filled with the hot gases from a burner using kerosene under pressure. These hot gases were drawn through the bed of stone on the pallets by the suction in the wind-box induced by the fan, thereby heating the stone to the required temperature. The travel of pallets was so regulated that the charge was held under the arch the desired length of time. The vacuum, velocity of the gases through the charge, the travel of the pallets, and operation of the oil burner were all regulated to produce a maximum transfer of heat from the gases to the charge.

This process produced well-calcined lime from all sizes of stone; the temperature was under control and overburning could be avoided, and no ash was present to cause slagging. The most marked disadvantage was that an excessive period of time was required for the heat to work down through the charge sufficiently to calcine completely the lower layers of the charge. The capacity of the machine was thereby reduced, and it was noted that when enough time had elapsed to calcine the charge completely, the upper layers tended to overburn from too long exposure to the intense heat at the surface. This was partly avoided by placing different sized stone in the pallets in layers, with the coarser material at the top and the finer at the bottom; the finer material required less heat and time for calcination.

Tests with Process No. 3. External Heat Supplemented by Fuel Mixed with Stone

This process is a combination of Nos. 1 and 2 and combines the advantages of each. Ignition of a small amount of solid fuel added to the charge of stone rapidly brought the temperature to a point sufficient to start calcination throughout the depth of the whole bed. This temperature was maintained by hot gases from the combustion of oil under the reverberatory arch for a length of time necessary to complete calcination. The time required was much less than in Process No. 2, on account of the preheating effect from the combustion of the coal mixed with the stone. A number of experiments were made in order to determine the most desirable percentage of coal in the charge and also the most efficient size in which this coal should be ground before mixture with the stone. It was found that the best ratio of coal was 5% of the weight of raw stone. When the percentage of coal was increased above this amount the effect of the ash became more and more pronounced until at 10% the injurious effect of slagging on the quality of the lime became very apparent. Five per cent was found to be the minimum amount which would propagate combustion satisfactorily throughout the charge. When the coal was reduced below this point it did not ignite or burn with enough violence for combustion to spread through the charge, and was consumed only after the charge had been heated by the flame from the oil burner.

Coal crushed to pass a 20-mesh screen was found to give most satisfactory service. This material contained a mixture of different sized particles varying from 20 mesh to minus 100 mesh. This size of coal was found to ignite most readily and burn completely through the charge when used with fine stone varying in size from half-inch particles to minus 20 mesh. Attempts to use coarser or finer coal were not so successful, as the coal did not ignite readily nor continue to burn with velocity enough to calcine the stone. Calcination of coarser stone containing little fine material, that is, stone whose dimensions varied from ⅛-in. to ½-in., was found to require slightly coarser coal. Minus 8-mesh coal was therefore used with the coarser stone.

The most useful solid fuel was found to be anthracite of the lowest possible ash and sulphur content. Coke also was acceptable and non-coking bituminous coals may also be used. Coking bituminous coals were not found to be good fuels for this purpose, as the coke formed by the first ignition expanded and tended to choke the draft. Complete combustion of the coke so formed was difficult, and unburned coke was found in the lime discharged from the machine. Attempts to use sawdust, shavings and similar substances were not particularly successful, as these materials burned out at the surface with great rapidity and did little to pre-heat the stone. When the firing temperature was carefully regulated and not allowed to become excessive, it was found that the ash from 5% coal was not injurious to the quality of the lime. Fluxing of the ash with the lime became most marked when the temperature exceeded 1100 deg. C. The fluxing action is also dependent upon the chemical composition of the ash and might be controlled by selection of a special coal.

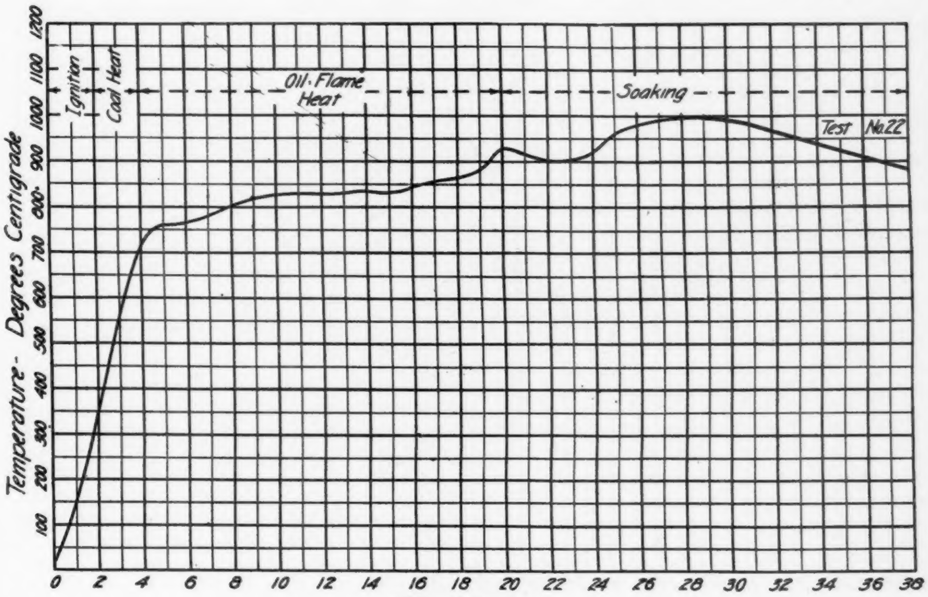


Fig. 1

Results of Tests by Process No. 3

A typical small-scale test made at this stage of the investigation is as follows: 18 lb. of stone between 2 and 8 mesh, was moistened and mixed with 5% of its weight, or 0.9 lb. of minus 8 mesh anthracite. This mixture was charged into the pallets and the machine started. As the pallets passed beneath the ignition chamber the coal became ignited and burned down through the charge. The rate of travel was so regulated that the pallets advanced under the reverberatory arch before the combustion of the coal was quite complete. The hot gases from the combustion of the oil beneath the arch completed the calcination. The partial vacuum in the wind box as indicated by the water gauge varied during the run from 1¾ to 2 in. Temperature of the exhaust gases did not exceed 150 deg. C. The stone was well calcined and the lime appeared to be of good

quality. A pyrometer was introduced in the charge at a point 2 in. below the surface, and during the run temperatures were determined every minute for a period of 40 minutes. At the end of the second minute the coal ignited and the ignition flame was shut off. The temperature had risen from 20 deg. C. to 320 deg. As the coal in the charge continued to burn the temperature rose to 710 deg. at the end of the fourth minute. Previous experience had shown that the combustion of the coal was completed in these small tests at this time. The oil flame under the arch was therefore started to complete calcination.

The temperatures continued to rise until 930 deg. was registered at the end of the twentieth minute. The oil flame was then shut off and the fan stopped to prevent any chilling action which might be induced by the suction of air under the arch, and the charge was allowed to soak in its own heat. After a slight drop the temperature again rose to a maximum of 995 deg. and then showed a gradual decline as the charge cooled. The rise in temperature is probably due to the slow conductivity of the excessive heat at the surface as it worked down to the level of the pyrometer couple. The gradual cooling of the charge after direct heating had stopped emphasizes the benefits that may be obtained by soaking the charge and permitting fireless calcination to complete the dissociation of the stone, thereby effecting a considerable saving in fuel. The accompanying time-temperature graph (Fig. 1) illustrates the progress of combustion during this test. In similar runs the maximum temperature attained reached 1200 deg. C., this maximum temperature being dependent upon the amount of oil consumed by the burner.

Continued experimental runs demonstrated that it was unnecessary to use a separate flame for the ignition of the coal. When the charge of stone and coal came under the arch the coal ignited at this point and preheated the charge equally as well as when ignited at an earlier time by a separate flame.

In order to obtain information concerning the consumption of fuel in relation to the production of lime, a number of tests were made in which the amount of oil consumed by the burner was measured. In a typical run 200 lb. of stone between 4 and 20 mesh were moistened and mixed with 10 lb. of minus 8-mesh coal. This charge was placed in the hopper provided with an auxiliary hopper designed to distribute 1 in. of previously burned lime to the bottom and sides of the pallet for grate dressing. The machine was started and regulated so that the stone was well calcined. The actual time in the firing zone for complete calcination of the charge did not exceed 20 minutes. The entire run was completed in 105 minutes. The 200 lb. of stone produced 112 lb. of lime with a consumption of 28 lb. of kerosene or a ratio of 4 lb. of lime to one of oil, to which the 10 lb. of coal must be added in calculating true fuel ratios. Analysis of the lime produced during the different tests showed great discrepancies, which were dependent upon the degree to which the test approached 100% calcination. As the investigation advanced the quality of the lime showed constant improvement and it was possible to produce lime containing over 90% CaO, which was as well as could be expected at this stage.

Difficulties Encountered with Small Machine

The work with the laboratory machine was continually hampered by the difficulties encountered in using kerosene for fuel, as the heat produced by its combustion was excessive and could not be evenly distributed. The lack of insulation caused great heat losses and lowered the apparent fuel ratios. The machine, being designed for the sintering of metallic ores, is not adapted for the calcination of lime, and was most deficient for this purpose in that it was constructed to discharge the sinter immediately after it had passed the wind box. This made it impossible to soak the lime in its own heat after it had passed the firing zone, and the benefits of fireless calcination were largely lost.

Tests with Large Machine

The results obtained with the laboratory machine were sufficiently promising to warrant continued investigation on a larger scale, for it was apparent that a large machine modified in accordance with information derived from the laboratory work would give better fuel ratios and a better product. Data which had been assembled from preliminary tests relative to the rate of lime production and machine capacity, indicated that the smallest type of machine regularly manufactured by the company for commercial metallurgical work could produce a tonnage of lime approaching commercial practice. This machine is provided with pallets 24 in. wide and a wind box 10 ft. long. The larger machines which are more commonly employed in sintering metallic ores have 42-in. pallets, the standard size, and wind boxes 22, 33 or 66 ft. long, according to the tonnage treated.

The machine was set up and provided with a special three-compartment feeding hopper by which burnt lime grate dressing, and two different sized charges of stone could be loaded into the pallets in layers of any desired thickness, up to the total depth of the pallet, which was 4 in. The grate bars in the pallets were malleable iron castings and had ¼-in. slots in a herringbone pattern. These slots were found to be too large, as there was some loss when stone finer than ¼-in. was burned. This difficulty was temporarily remedied by fastening 8-mesh galvanized metal cloth to the grates. When first set up the machine was driven by a 1-hp. motor and the fan by a 5-hp. motor. The driving motor was connected by belt and pulley directly to the gears by which the high speed of the motor is reduced to the very slow speed at which the pallet-driving wheel revolves. Speed cones permit adjustment of the speed of the machine during operation. A flat arch of 4-in. firebrick was constructed above the machine the entire length of the wind box at such a height that there was a clearance of 8 in. between the arch and the surface of the stone in the pallets. Burners were placed directly in front of the loading hopper so that the flame was projected forward in the same direction as the pallets travel. The burners were supplied with kerosene under 45 to 60-lb. pressure and air at 85-lb. pressure.

During the first experimental runs a number of deficiencies developed in the original set-up, and these were corrected as they appeared. Great difficulty was experienced in obtaining a uniform distribution of heat from the burners so that the lime could be calcined without overburning or underburning some parts of the charge. This was corrected by constructing a combustion chamber directly in front of the burner. This chamber was provided with a flaring throat in which small bricks of fire clay were placed in staggered rows to separate and spread out the flame in a uniform sheet. The throat of this chamber opened just above the surface of the stone in the pallets, and the hot gases from the combustion of the oil were drawn out and down through the stone by the suction of the wind box. As formerly indicated, kerosene is not a suitable fuel for the calcination of limestone with this machine; it produces a short intense flame several hundred degrees hotter than necessary, making it difficult to avoid overburning the stone. Due to local conditions no other fuel could be utilized conveniently.

Tests were made in order to investigate the many different factors that affect the efficiency of the machine in making lime. Different types of burners were used, their position and number on the machine changed, the reverberatory arch was repeatedly rebuilt, the high pressure sintering fan was replaced by a low-pressure exhauster, and many runs were made in which the size of stone, amount of fuel, rate of travel, speed of fan and temperatures were varied until data and experience were accumulated which permitted operation of the machine on a standardized schedule.

The machine was now equipped with one No. 1 Best oil burner. This was slotted to give a spread of 24 in. to the flame, which was evenly distributed by the combustion chamber. The reverberatory arch had been lowered until the maximum height above the surface of the stone was 4 in., this tapering down until at the discharge end the gap was only ½-in. The arch thus acted as a seal and reduced the escape of heat. A dismantled automobile provided with a shaft and pulley was employed to drive a 30-in. fan which had been substituted for the smaller fan first used. From 5 to 10-hp. depending on speed, volume of gases, etc., was required to drive this larger fan.

The first experimental runs confirmed the results obtained with the laboratory machine. Five per cent of coal was again found to be the most efficient and serviceable quantity.

Change in position of the burners demonstrated that the best results could be obtained when the burner was placed just in front of the loading hopper, and projecting its flame in the direction of travel of the pallet. When the burner was in this position the cold stone in the charge was exposed to the greatest heat as soon as it passed beneath the combustion chamber, and as the pallet moved forward the temperature decreased as the distance from the burner increased. This permitted immediate and vigorous ignition of the coal. The temperature was sufficiently raised so that calcination still progressed as the stone was moved to cooler zones.

This method of firing is directly opposite to the method used in the rotary kiln where the cold stone enters at the cool end of the kiln, and progresses toward the burner into constantly increasing temperatures until the finished lime is discharged. This permits preheating of the cold stone by the hot waste gases, and undoubtedly is the most efficient manner of operating a rotary kiln. When the burner was placed at the discharge end of the sintering machine, thus projecting its flame in an opposite direction to the travel of the pallets, the stone was more gradually heated (which may have been of value as regards heat conservation), but the ignition of the coal was slow and not satisfactory, as unconsumed coal was often discharged with the lime. This was largely due to the flame produced by the burning kerosene being too short to reach effectively to the point where the coal charge entered the burning zone. The best position for the burner on the sintering machine has not been definitely fixed; it depends upon the length of the machine, the length and position of the wind box, type of fuel employed and other factors which may vary greatly with local conditions.

Typical Runs with the Large Machine

A representative run is as follows: 1,000 lb. of Bellefonte high calcium stone, the analysis of which has been given, was mixed with 50 lb. or 5% by weight of coal. The stone was screened to minus ⅝-in., plus ¼-in. size. The coal was crushed to pass an 8-mesh screen. This charge was moistened to increase the adherence of the coal, well mixed and then transferred to the loading hoppers. A 1-in. grate-dressing of previously burned lime was used in the pallets, and above this was placed 3 in. of raw stone. The pallets traveled at a rate of 1 ft. in five minutes. In order to increase the time of calcination the travel of the machine was stopped twice for 10-minute periods, thereby holding the stone a greater length of time in the hot zone. The run was completed in 2 hours and 23 minutes, and produced 570 lb. of well-burned lime with a consumption of 132 lb. of kerosene, or a fuel ratio of 4.4 lb. of lime to 1 lb. of oil, plus 5% coal. During the run the temperatures of the exhaust gas at the fan were measured. These varied from 180 deg. C. to 228 deg. C. and averaged 212 deg. C. The volume of air, measured with a Pitot tube, was found to average 1470 cu. ft. per min., or 73 cu. ft. per sq. ft. of grate surface over the wind box, as the latter had an area of 20 sq. ft.

Other tests indicated that this size of stone could be calcined in approximately 35 min. in the firing zone with a fuel ratio varying from 4 to 4.5 of lime to 1 of oil. The flow of air to the fan was so regulated by the damper opening that the volume of exhaust gases was varied from 50 to 125 cu. ft. per minute for each square foot of grate surface. The lower volumes were found to be most satisfactory. Temperature determinations along the surface of the stone showed 1150 deg. C. at a distance of 4 ft. from the burner, 1180 deg. at 5 ft. from the burner, and 1020 deg. at 8 ft. from the burner. The temperature at the bottom of the pallets as they discharged was 790 deg.

Similar runs were made using two different sizes of stone. In a typical run 1 in. of grate dressing was placed in the pallets, above this a 1½-in. layer of stone ¼ to ½-in. in size, and finally a layer 2 in. deep of stone ½ to ¾-in. in size. This mixture of sizes calcined well in this position. The larger stone in the upper layer was exposed to greater temperatures than the finer stone beneath and calcined more rapidly, thus calcination of all parts of the charge was finished at approximately the same time.

Experiments with Lengthened Machine

The same difficulty was experienced with this machine that had been encountered with the laboratory model in that the length was too short. As the hot lime was discharged immediately after passing the wind box no fireless calcination was possible, and fuel ratios were thereby lowered. The machine was then lengthened by extending a distance of 10 ft. the track on which the pallet travel. Fourteen extra pallets were added, filling up the space and constituting an endless conveyor. The brick arch was extended over this additional 10 ft. of track. This construction permitted the use of the entire 10 ft. of wind box for firing, and gave the lime an additional 10 ft. in which to soak and cool slowly after leaving the firing zone. This extra 10 ft. of track provides 30 to 45 min. of extra time, depending on the rate of travel. The effect of this extended period of time during which the stone is still hot enough to continue calcination is to produce a much better calcined product and to lower the fuel consumption. It was found that the machine could be operated at a greater rate of speed when the lime was heated this additional period of time, and a larger amount of stone was thereby passed through the firing zone with no greater consumption of fuel.

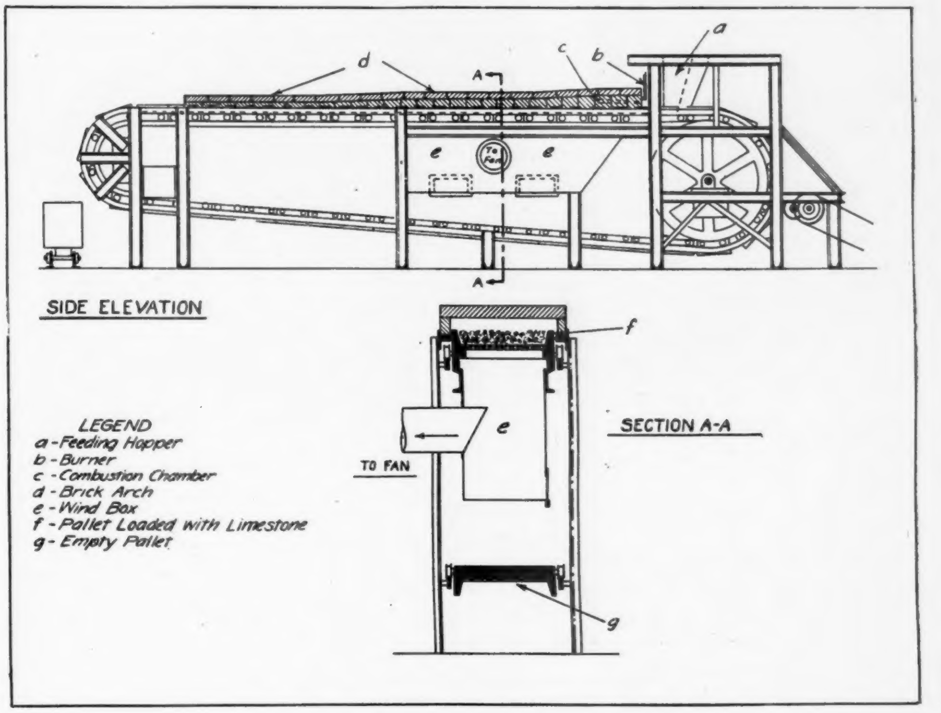


Fig. 2—Experimental sintering machine

Due to the very high temperature produced by the combustion of kerosene, the lime on the surface of the charge in the pallets tended to overburn if the pallets were permitted to stay in the firing zone long enough to allow calcination of the lower layers of the charge. This was overcome by rabbling the charge during calcination. Small plows made of "hybnickel" metal were placed in two rows of four across the width of the wind box. These rabbles were mounted on two bars fastened to the firebrick arch in such position that the charge of stone in the pallets was turned over without disturbing the grate dressing. The rabbles on the two bars were staggered and also were so shaped that the first row turned the stone to the left and the second to the right, hence the stone was turned over and left almost in its orig-

inal position. This rabbling aided in producing a more uniformly calcined charge. The accompanying diagram (Fig. 2) illustrates the lengthened sintering machine furnished with the necessary special equipment for the calcination of small limestone.

Results of Tests with Lengthened Machine

Typical runs with this installation are as follows: Test No. 51: 1800 lb. of Bellefonte stone, ¼ to ⅝ in. in size, were moistened and mixed with 5% by weight, or 90 lb. of minus 8-mesh anthracite. The dry coal had the following approximate analysis:

Ash	13.9
Volatile	4.1
Fixed carbon	82.0
	100.0

The moisture content was 2.40 and sulphur 0.85. The B.t.u. valve was approximately 13,000.

This mixture of stone and coal was placed in the loading hopper and charged in the pallets on 1-in. of grate dressing. Fifty pounds of stone filled one pallet. The rate of travel of the pallets was varied during the run from 3 min. and 10 sec. to 4 min. and 23 sec. per foot. To insure complete calcination the travel was stopped twice during the run for periods of 10 min. When opened to full capacity the burner used 1 lb. of kerosene per minute, which produced excessive heat; the burner was therefore operated at reduced capacity. The total length of time that the charge was in the burning zone was 50 min., total length of run 4 hr. and 39 min.; total oil consumption 186.5 lb. or 0.67 lb. per minute. The fuel consumption was one pound of oil (plus the 5% coal) for each 5.6 lb. of lime produced. The lime was well burned with little evidence of core.

Test No. 55: 2400 lb. of Bellefonte stone of the same size as in the preceding test were mixed with 120 lb. of coal. The rate of travel of the pallets was 3 min. and 25 sec. per foot. Travel was stopped five times during the run for 10 min. periods. The total length of run was 5 hr. and 20 min.; total oil consumption 295 lb. or 0.92 lb. per min.; fuel consumption 1 lb. of kerosene plus 5% coal, per 4.7 lb. of lime. Temperature determinations made at the surface of the charge were as follows: at a distance of 6 ft. from burner, 1120 deg. C.; at 10 ft. from burner, 960 deg.; at 20 ft. from the burner the temperature of the lime as it discharged was 510 deg. The temperature of the exhaust gases at the fan was 125 deg., which was lower than normal due to cold weather. Measurement of the volume of gases averaged 2400 cu. ft. per min., or 120 cu. ft. per sq. ft. of grate surface above the wind box.

The lime was apparently well calcined. The five periods of 10 min. each during which the travel of the machine was stopped and no lime was discharged increased the consumption of oil fuel with regard to the amount of lime produced. The burner was operated at nearly full capacity as indicated by the use of 0.92 lb. of oil per minute. The apparent fuel ratios were thereby lowered.

A few tests which were made with a local dolomite gave much better fuel ratios. This stone calcined very readily and pieces up to 2 in. in diameter were well burned after passage through the machine. Fuel ratios up to 7 lb. of lime per pound of kerosene, plus 5% coal were attained with this stone.

Fuel Ratios Obtained

A general average of all tests made with the Bellefonte stone averaged 5.5 lb. of lime per pound of kerosene, plus 5% coal. The use of kerosene in this experimental work increases the difficulty of comparison of the results attained with commercial practice. Rotary kilns which are successfully used for the calcination of small stone at present are fired either with fuel oil with a heating value averaging 20,000 B.t.u. or else with producer gas made from coal averaging 13,600 B.t.u. With these fuels the ratio of pounds of lime to pounds of fuel for good practice may be represented by an average figure of 3 lb. of lime for one pound of coal and 5 lb. of lime for 1 lb. of oil. Assuming these figures to be correct the calcination of 1 ton of high calcium limestone which would produce 1160 lb. of lime would require 387 lb. of coal (B.t.u. 13,600) or 5,263,200 B.t.u. when the coal is gasified in a producer and burned in a rotary kiln. Using fuel oil the rotary kiln would require 232 lb. (B.t.u. 20,000) or 4,640,000 B.t.u. The sintering machine would require 211 lb. of kerosene (B.t.u 19,500) and 100 lb. of coal (B.t.u. 13,000) or a total of 5,414,500 B.t.u. Local factors which affect the combustion or different fuels may show such great variation that it is impossible to accept these figures literally; however, they indicate that the experimental results are comparable to commercial practice.

Analyses of the lime produced during the different tests showed a widely varying content of CaO which was naturally dependent upon the thoroughness of calcination. Where calcination was apparently good and core could not be detected by visual examination, the lime content was found to be 95 per cent, or better, which equals the specification of lime for most industrial uses. The lime from most runs averaged 90%. This was due to experimental conditions which could not be remedied at the time.

Kerosene is not a good fuel for lime burning. The flame is too short and too hot so that even distribution of the heat is difficult, and the lime tends to be overburned at the surface if the time period is long enough for calcination of the entire charge. The machine after lengthening was still too short, also the position of the wind box could not be changed without construction of a new machine. The fact that the wind box was located directly in front of the burner tended to shorten the flame as it was drawn down by the vacuum. This shortened the distance in which the charge could be heated by the hot gases. The rabbles which were employed were installed temporarily and were not as efficient as could be desired. Their use demonstrated that correctly designed rabbling equipment by which the charge could be thoroughly turned over, thereby bringing the cold stone up from the bottom of the charge and turning under the heated stone on the surface, would greatly improve the uniformity of calcination.

Practically no insulation was used at any point on the machine. This resulted in high radiation losses which could be avoided in a permanent installation. The design of the arch was not correct for most efficient results. The flat arch did not permit as good a reverberatory effect as could be obtained with a correctly designed curved arch. Although the grate dressing was satisfactory, and remedied the difficulties experienced from incomplete calcination of the stone in contact with the metal of the pallets it is probable that this could be further improved by lining the sides of the pallets with firebrick. These various difficulties which could not be avoided in experimental work could be readily overcome in commercial practice, and their correction would undoubtedly result in better calcination and improved fuel ratios.

Air Required for Combustion

The seal between the pallets and the wind box was not tight and this resulted in a leakage of air which increased the load on the fan. When the burner was drawing kerosene at its maximum rate of 1 lb. per minute only 187.3 cu. ft. of air are required for the combustion of this fuel. The total gases produced by combustion of the fuels (kerosene and coal) plus CO_2 from the limestone should not exceed 475 cu. ft. per min. at 212 deg. C.

The measurements made during the tests showed the volume to vary from 1200 to 2400 cu. ft. per min., which is greatly in excess of the necessary amount.

Properties of Lime Produced by the Sintering Machine

The time of calcination is known to have some effect upon the qualities of the lime obtained. Lime produced in the rotary kiln, where the total time of calcination seldom exceeds three hours, is known to exhibit great variation in its physical properties from lime made from the same stone in a shaft kiln where the total time for passage of the stone through the kiln may reach a maximum of 72 hours. The lime produced by the sintering machine is calcined in an extremely short time, and it is possible that this short time interval together with the sudden exposure of the stone to high temperatures may produce peculiar physical properties. The lime slakes with great rapidity, at times almost with explosive violence. This is aided by the small size of the fragments and their accompanying large surface exposure.

When the temperatures were carefully regulated no evidence of slagging of the ash of the coal was noted. The activity of lime as a flux makes it essential that

this feature by closely watched. When proper temperatures were maintained the lime was of good color and showed no signs of contamination. The ash of the coal dusted off the lime in a fine powder which was not noticeable. From the evidence available at present it does not seem probable that lime made in this machine could be marketed as quicklime. Its tendency to rapid hydration would make such a procedure difficult, as it would require storage in air-tight containers immediately after calcination. The most feasible utilization of the lime would be to hydrate it immediately. This would have the additional valuable feature of subjecting the lime to air separation by which the core and much of the ash could be eliminated and the purity of the product increased.

Possible Utilization of the Sintering Machine in the Manufacture of Lime

This investigation has indicated that the sintering machine has excellent possibilities in the production of lime from small stone. The standard metallurgical machine would require considerable redesigning to meet the peculiar requirements of lime burning, and the purpose of this investigation in part was to determine what these changes should be. Data available indicate that the machine would be most valuable in the calcination of fines not exceeding ¼ in. in diameter. Coarser material can be burned but only by increasing the period of calcination which lowers the tonnage below a feasible amount. Material as fine as 20 mesh can be calcined and possibly finer if the grate bars were specially designed. To insure uniform calcination the charge should be sized to fairly close limits, the diameter of the largest particle not being over three times the diameter of the smallest. Stage crushing and screening to produce a series of graded products from ¾ in. to dust would permit the preparation of a series of sizes which could be burned in rotation.

The smallest machine which would produce a commercial tonnage of lime would probably be provided with a 33-ft. wind box and sufficient extension to permit soaking of the heated lime to allow fireless calcination. Experimental data indicates that a square foot of wind-box surface will produce at least 300 lb. of lime per 24 hours. Such a machine provided with the standard 42-in. pallets would therefore have 115.5 sq. ft. of surface and should produce 34,650 lb. of lime in 24 hours, which is the equivalent of ordinary shaft kiln production. The power requirements of this machine should not exceed 2 hp. for moving the pallets and 35 hp. for operation of the fan. It is essential that such a machine be provided with a correctly designed reverberatory arch, efficient rabbling devices, proper firing equipment and insulation at points where heat losses might occur. Sintering machines have the advantage of being installed in small units at comparatively low initial cost. Being nearly automatic in operation, little supervision is required and it is believed that upkeep costs would be very low.

Considerable choice is possible in fuels. The cheapness and ease with which oil burning equipment may be installed has much to recommend it. The excessive heat and short flame of kerosene oil were found to be serious objections to its use in this investigation. Producer gas would undoubtedly be an excellent fuel. The principal objection to its use is its comparatively poor economy due to the heat losses in the producer during the combustion of the coal. The use of powdered coal would be very desirable due to its economy, provided it could be burned without contamination of the lime by ash. It seems possible that this can be accomplished by construction of a long combustion chamber along the sides of the wind box in which the coal would be burned. Ports from this combustion chamber opening above the surface of the charge in the pallets would permit the hot gases from the combustion of the coal to pass through the stone and effect calcination. Baffles in the combustion chamber should retain much of the ash from the coal. With sufficient rabbling equipment to turn the charge over repeatedly the addition of solid coal to the charge might be unnecessary, as calcination by the hot gases alone should be sufficient. The addition of coal was found to be of such great assistance in rapidly heating the stone to the bottom of the charge that its use seems advisable unless contamination from the ash cannot be overcome by air separation of the lime hydrate.

It is anticipated that a machine of commercial size designed specially for the calcination of small limestone and supplied with the equipment that this investigation has shown necessary will produce more perfectly calcined lime at much better fuel ratios than have been attained in the experimental work.

Acknowledgments

The writer wishes to acknowledge the co-operation of the Charles Warner Co. of Wilmington, Del., and the American Lime and Stone Co., Bellefonte, Penn., who furnished the necessary raw material to carry on this investigation and also supplied valuable data concerning the calcination of small stone. Particular thanks are due to E. E. Eakins of the Charles Warner Co. for many suggestions, and to R. W. Hyde, research engineer of the Dwight and Lloyd Metallurgical Co., who was in charge of the entire investigation.

Why Glass Makers Prefer Dolomitic Limestones

LIMESTONE which is practically 100% $CaCO_3$ is not desirable in a glass batch, says W. H. Meacham, vice-president and general manager of the Chattanooga Bottle and Glass Mfg. Co., in a recent article in *Ceramic Industry*. The reasons are all, he says, purely physical for a chemically pure limestone is to be desired, for it would then have only traces of iron and alumina, both of which are bothersome in a glass batch.

Mr. Meacham goes on to say:

"Lime is primarily a fluxing agent and aids in forming a glass which is resistant to weathering and almost insoluble in hot or cold water. In order to exert its full measure of influence on the other glass chemicals, mainly sand, it must become intimately mixed with the material which it is to aid in melting. To do this it should be ground to about the same fineness as the sand and thoroughly mixed in a batch mixer. It then should be stored in a batch hopper located either above or below the tank.

"Every time the batch is transported a certain amount of dust is raised and it seems that a limestone of practically 100% $CaCO_3$ dusts a great deal more than a magnesia lime. I have tried to use high calcium limestone, but the men complain of the caustic action of the dust, and as men must necessarily have good working conditions, we use magnesia lime.

"Another reason for not using the high calcium limestone is that it has a tendency to settle out. As you know, a certain amount of vibration is present in plants where conveyors and other machinery is used. These vibrations are naturally present in a huge bin supported by girders and built in proximity to running machinery. This constant vibrating, I have found, is sufficient to cause a high calcium limestone to settle out to such an extent that when the tank is filled this limestone does not flux properly because it has segregated and I have seen great lumps of it as far forward as the second and third ports in a tank.

"There is a difference between limestone which is fresh and that which has been allowed to remain in storage over a period of time. The former has more life than the latter. The reason I know this is because of the fluxing action in the tank. The glass will fuse and clear much sooner when newly ground limestone is used in the batch. If it is possible, grind daily the limestone to be used, and you will find a great difference in the time it requires to melt your glass, and also how much quicker the glass will clear up.

"The limestone we are using runs about 57% $CaCo_3$ and 40 to 41% $MgCo_3$, and close to .04% iron. We have been using this limestone over a long period and we have had excellent results."

Raw Ground Rock Phosphate Industry of Tennessee

History of an Industry That Declined After the War but Which Is Now Regaining Its Former Strength

By Richard W. Smith

Assistant State Geologist of Georgia
Formerly Assistant Geologist, Tennessee Geological Survey

(Photographs by R. S. Bassler)

THE use of finely ground South Carolina phosphate for direct application to the field was recommended as early as 1870, and a number of the phosphate mining concerns then operating at Charleston advertised the material for sale. In 1889, when the Florida hard rock phosphate fields were discovered, a considerable tonnage of soft phosphate (consisting chiefly of aluminum phosphate), which is found associated with the hard rock, was used locally by the farmers, and in a good many instances with success. Some early adverse reports on the agricultural value of raw rock phosphate, coupled with the rapid establishing of plants for the manufacture of the more soluble and undoubtedly more quickly acting superphosphate, led to the practical cessation of the use of this raw material in the South.

In 1905 Hopkins of the Illinois Experiment Station began advocating the use of raw ground phosphate rock as a fertilizer, and since that time the Illinois station has made numerous experiments and has continuously advised the use of this material for general farming in preference to any other form of phosphate carrier.

During this time other states conducted experiments with raw ground rock phosphate with many conflicting conclusions regarding its agricultural value, conclusions which in many instances have been drawn from insufficient data. There has been a constant antagonism due to prejudice and the natural opposition of the makers of other forms of fertilizer.

In spite of this, the use of raw rock phosphate directly as a fertilizer slowly increased (until the slump of 1921) as is shown by the following table of its production in the United States since 1914, when the U. S. Geological Survey first began to tabulate separately the phosphate rock sold in this form:

Year	Long Tons
1914	48,317
1915	50,468
1916	70,233
1917	75,861
1918	45,294
1919	79,189
1920	72,801
1921	13,203
1922	16,029
1923	10,548

Much of this demand has been in the corn belt of the Middle Western states, particularly in Illinois, although raw ground rock phosphate has been used to a small extent in many other states.

So much doubt and difference of opinion existed regarding the value of raw ground rock phosphate as a fertilizer, that in 1918 W. H. Waggaman and C. R. Wagner of the U. S. Department of Agriculture published a bulletin[1] in which they attempted to analyze and sum up the experimental work on the subject. After eliminating all experiments not carried on for a sufficiently long time or with insufficient accuracy, they conclude that, although no two of the 37 experiments considered were made under the same conditions and therefore comparisons are apt to be erroneous, the following results were indicated:

1. Of 22 experiments comparing raw rock with acid phosphate, 13 were favorable to raw rock and 9 unfavorable.
2. Of 15 experiments making no comparison of raw rock with acid phosphate, 11 were favorable and 4 unfavorable.
3. Of 21 experiments where the raw rock applications were relatively light, 15 were favorable and 6 unfavorable.
4. Of 16 experiments where the raw rock applications were liberal, 14 were favorable and 3 unfavorable.
5. Of 23 experiments where raw rock was used in connection with organic matter, 18 were favorable and 5 unfavorable.
6. Of the 37 experiments, 17 showed a cumulative effect over a number of years, 7 showed no cumulative effect, and 13 were inconclusive as to the cumulative effect.

From these results the authors drew the following conclusions:

1. The application of liberal (over 1000 lb. per acre) and even medium quantities of

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Typical formation at mine entrance

[1] Waggaman, W. H., and Wagner, C. R., Analysis of experimental work with ground raw rock phosphate as a fertilizer: U. S. Dept. Agric., Bull. 699, Oct. 16th, 1918.

raw rock phosphates to most soils produces an increase in the yields of many crops the first year.

2. The effectiveness of raw rock phosphate depends largely on its distribution in the soil, this distribution being brought about by liberal applications of very finely divided material (at least 95% through a 100-mesh screen) and through cultivation.

3. The presence of decaying organic matter in the soil increases the effectiveness of ground raw rock phosphate, owing probably both to greater bacterial activity and the higher content of carbon dioxide in such soils.

4. As a corollary of (2) and (3) the effectiveness of raw rock phosphate is usually increased after remaining in the soil for a year or more.

5. Most crops respond more quickly to applications of acid phosphate than to raw rock phosphate. Therefore, where early stimulation and quick maturity of the crop are the main considerations, acid phosphate is probably the best form of phosphoric acid to apply.

6. The question whether increases in yield can ordinarily be produced more economically by one form of phosphate or the other must be considered in a measure as a separate problem for each farmer, since it depends on a number of factors of which the most important are the nature of the soil, the crop system employed, the price of the various phosphates in each particular locality, and the length of the growing season.

As the Middle Western states have been the principal users of raw ground rock phosphate, Tennessee has always supplied the greater part of the demand. The industry steadily increased until in 1909 six Tennessee companies were grinding phosphate for this purpose. In 1920 there were seven companies producing raw ground rock phosphate; two in the Mount Pleasant district, one in the Columbia district, and four in the Centreville brown rock district. In 1921 the boom of the previous three years suddenly ceased and the ground rock industry came to a practical standstill from which it is only now recovering. At present three companies are producing raw ground rock phosphate in Tennessee: The Ruhm Phosphate and Chemical Co. of Mt. Pleasant, the Standard Fertilizer Co. and the Tennessee-Illinois Phosphate Co., both at Twomey near Centreville. The Ruhm Phosphate and Chemical Co. grinds washed brown phosphate, while the two Centreville companies have deposits of disintegrated brown phosphate sufficiently rich to use without washing, by eliminating some of the impurities by air separation after drying but before grinding.

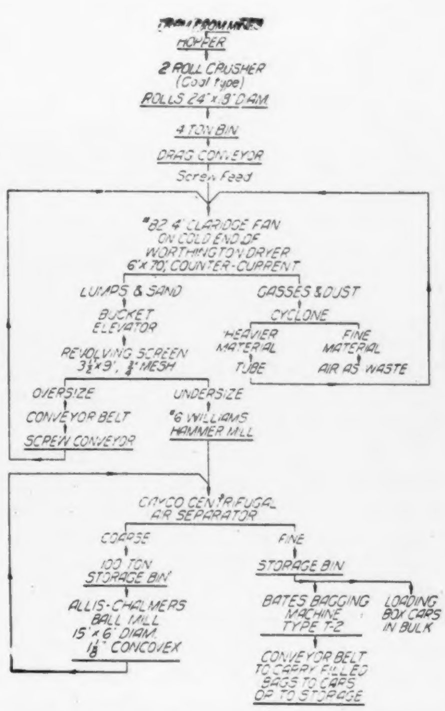
The phosphate is mined in the usual way as described in an article by the author in the April 18, 1924, issue of ROCK PRODUCTS.

The process of preparation consists usually of a preliminary crushing through roll crushers to break up the large lumps; drying in rotary cylindrical dryers; a coarse grinding, sometimes omitted, in some form of crusher or hammer mill; and a fine grinding in a Raymond air separation mill, or a ball or ring-roll mill followed by an air separator to return the coarse material to the system. The following description of the plant of the Tennessee-Illinois company at Twomey, near Centreville, Tenn., is given as an example of a well equipped plant for producing ground rock phosphate.

Plant of Tennessee-Illinois Phosphate Co.

Description of One of the Leading Producing Units

The Tennessee-Illinois Phosphate Co.'s plant is located on the east side of Indian creek at Twomey, Tenn., on the Centreville branch of the Nashville, Chattanooga and St. Louis railway, one mile south of Centreville. The mine is in a deposit of brown Leipers (Ordovician) phosphate of the rim and semi-blanket type, varying from a few feet to 30 ft. in thickness, overlaid by 10 to 20 ft. of overburden. The phosphate is mostly a disintegrated sand with but few limestone "horses." The overburden is stripped with a Marion, class 31, dragline excavator with a 40-ft. boom and a ¾-yd. Page bucket.



Typical flow sheet of phosphate plant

The phosphate is mined by hand labor with a pick and shovel and loaded into 2-ton, end-dump tram cars which run by gravity to the plant, where they are dumped into a hopper at the top of the building. The empty cars are hauled back by a mule.

The accompanying sketch shows the flowsheet of the plant. From the hopper the phosphate passes through a two-roll crusher, to break up the large lumps, into a 4-ton bin. A drag conveyor and a feeding screw feed the material from the bin to a Worthington revolving, coal-fired dryer, 6 ft. in diameter and 70 ft. long. A 4-ft. Claridge fan on the cold end of the dryer forces the heat and gases through the dryer in the opposite direction to the phosphate rock. This draft sucks up the fine dust as the material passes through the dryer, and carries it to a cyclone on the top of the building. The cyclone returns the heavier particles to the feed of the dryer, and blows the lighter particles, consisting of much of the clay and some fine phosphate sand, out into the air as waste. In a 100-ton run the cyclone eliminates about 10 tons of dust containing 20% to 25% bone phosphate of lime.

The material discharged from the dryer is carried to a revolving screen with a ¾-in. mesh. The oversize from this screen, consisting of mud balls formed in the dryer and pieces of flint that were not broken in the rolls, is returned to the feed of the dryer by a conveyor belt and a screw conveyor. The screw conveyor breaks up the mud balls and the flints keep circulating through the system. Once a week the screw conveyor is reversed and the pieces of flint that have

Typical methods of open mining

accumulated are thrown out on the ground.

The undersize from the revolving screen is ground in a No. 6 Williams hammer mill. The discharge from the hammer mill is carried to a Gayco centrifugal air separator, adjusted to separate the particles finer than 100 mesh from the coarser particles. The fine material goes directly to the final storage bin. The coarse material goes to a 100-ton storage bin which feeds to an Allis-Chalmers ball mill, 6 ft. in diameter by 15 ft. long, containing ⅞-in. round and 1⅛-in. concovex steel balls. The discharge from the ball mill is returned to the Gayco air separator, making a closed circuit of which the only output is the fine material from the separator.

The final storage bin feeds by gravity to the loading platform for loading paper lined box cars in bulk, or to a Bates bagging machine, type T-2. From the bagging machine a reversible conveyor belt carries the filled bags to the loading platform or to the storage shed.

The plant was built in 1920 and has a capacity of 125 tons per 10-hr. run, of ground phosphate guaranteed 65% bone phosphate of lime and 95% through a 100-mesh screen.

Raw ground phosphate is finding a new and increasing use as one of the ingredients of hog feed, for the purpose of furnishing the necessary phosphorus for bone and tissue building. In 1923, over 10,000 tons of ground phosphate rock were shipped from Tennessee to various feed companies in the United States. The Moorman Manufacturing Co. of Quincy, Ill., conducted a series of experiments in 1923 to determine the relative value of various substances containing phosphorus in hog feeding. The results of these experiments,[2] as determined by the size, density and mineral content of the bones and the general health of the hogs during the feeding tests, proved conclusively that raw ground rock phosphate was the best and most economical source of phosphorus for hog feeds. It is doubtful, however, if rock phosphate is suitable for farm animals other than hogs.

Raw ground rock phosphate and acid phosphate have separate and distinct agricultural functions; raw ground rock as a soil and general fertility builder, and acid phosphate as a means of feeding and forcing the particular crop to which it is applied; and neither can take the other's place. Further careful and long time experiments are needed to show the value of raw ground rock phosphate for particular soils and localities. With facts and not prejudice to go by, its future will undoubtedly be secure. Its future in Illinois is certain.

[2] Effects of certain calcium and phosphorus supplements on the skeleton of hogs: Mooreman's Mineral Mixture Experiment Station, Bull. 5, June, 1924.

New Illinois Geological Survey Bulletins

IN addition to the publications previously announced by the Illinois Geological Survey, four additional bulletins have just been issued from the press.

Bulletin 47, by Charles Butts, covers the Equality-Shawneetown area which adjoins on the south the well known Hardin county fluorspar district, which has previously been described in Survey Bulletin 41. The mineral resources discussed in Bulletin 47 include, in the order of their importance, coal, limestone, chert and road metal and ballast, and shale for brick and tile. The bulletin includes 76 pages and two engraved maps on the scale of 1 in. to the mile.

Bulletin 48, by J. E. Lamar, deals with the Carbondale area, in which coal is the most important mineral resource. The bulletin, however, sets forth such possibilities as there are in finding limestone, oil and gas, shales and sand and gravel. This report describes in detail for the first time the entire Chester series of the Mississippian system.

Occurrence and Properties of Molding Sands

Bulletin 50, by M. S. Littlefield, describes the places of occurrence and physical properties of the natural bonded molding sands in Illinois. A series of county maps is included showing the locations of molding sand deposits, and tables are given of the results of tests made on 137 samples from various parts of Illinois, the tests being made in accordance with procedures recommended by the American Foundrymen's Association. Twenty-nine new deposits of commercial promise were found and sampled.

Bulletin 52, by A. C. Noe, describes the Pennsylvania ("Coal Measures") flora of northern Illinois.

The above bulletins may be obtained by writing the Chief, State Geological Survey, Urbana, Ill., and enclosing 40 cents in postage or currency for each bulletin.

Finance Blast-Furnace Slag Study

THE American Institute of Mining and Metallurgical Engineers, after careful investigation, has recommended an appropriation by Engineering Foundation to aid Prof. Richard S. McCaffery, head of the department of metallurgy of the University of Wisconsin, in continuing a study of blast-furnace slags. This investigation was undertaken to determine the quality of different iron blast-furnace slags as desulphurizing agents and the possibility of using in the blast furnace materials of higher sulphur content than is now usual. The solution of the problem would render feasible the use of higher-sulphur iron ores for pig iron, the use of coke containing more sulphur than is now practicable and the economical manufacture of irons and steels of lower sulphur content. This research promises results of great importance not only to the iron and steel industries but to several others and to the users of their products. The board of Engineering Foundation has voted financial assistance.—*Engineering and Mining Journal-Press.*

Kansas Sand Royalties

ROYALTIES paid the state for sand removed from Kansas rivers, whose beds are owned by the state, have amounted to $46,045 in the last 15 months, W. E. Davis, state auditor, announced. The state has obtained $355,247 from this source since the enactment of the sand royalty law in 1913.—*Wichita (Kan.) Eagle.*

Current Abstracts of Foreign Literature

Properties of Aluminous Cements.—The chemical properties and the constituents, and therefore to a large extent, the value as a building material of aluminous cements, are represented by their position in the lime-silica-alumina system plotted on the Gibbs triangular co-ordinate method. Aluminous cements develop a strength in 24 hr. that is equal to that of portland cement in 28 days. This rapid hardening is accomplished by a slow setting, which is of importance in building operations.

The hardening process is accomplished by a considerable rise in the temperature which enables the cement to be used in cold weather with the minimum of protection. Aluminous cement offers much greater resistance than portland cement to attack by waters containing alkalies, acids, sulphates or magnesium salts and is therefore very valuable in sea-water work. The price of the cement is double that of portland cement, but a much leaner mix can be used and the rapid hardening properties permit of economy in time and in initial outlay on forms, shuttering and the like. *Chemiker Zeitung* (1926), 165-7, 202-4, 239-240 and 245-248.

Making Aluminous Cements. Aluminous cements are made by heating the raw materials in a very fine state of subdivision to a temperature below the clinkering point, preferably to a temperature of 1000 to 1100 deg. C. It is unnecessary to use pure materials, and limestone, clay, hydraulic lime, iron ore and silicious, silico-aluminous and silico-alumino-calcareous rocks may be utilized. The composition of the resulting cement may be varied within wide limits, namely, silica from zero to 5%, alumina 40 to 55%, iron oxide 10 to 25% and lime 20 to 40%. British Patent No. 250,246.

Constitution of Portland Cement Clinker.—In spite of the numerous researches that have been made on the constitution of the portland cement clinker and the nature of the setting and the hardening of the cement, the physical-chemical processes that are involved are not thoroughly understood. Hence it was thought worth while to gain some additional information on this subject by the use of the X-ray. Various X-ray diagrams were thus developed with different cements, such as blast-furnace cement in different states of subdivision, iron portland cements and straight portland cements. The results that were obtained with these various cements are given in the following tabulation:

Blast furnace clinker, air ground	No interference rings
Blast furnace clinker, water ground	No interference rings
Blast furnace cement	No interference rings
Iron portland cement	Slight trace of interference rings
Portland cement	Weak interference rings
Electro-cement	Interference rings clearly dissolved in small points
Portland cement, normal sample	Clear signs of interference rings
Portland cement, 1 to 2 hr. after making	Small interference rings
Portland cement, 3 to 4 hr. after making	Small interference rings

The general conclusions drawn from these preliminary experiments is that the X-ray can serve to some useful purpose in determining the structural characteristics of the various cements. *Zement* (1926), 220-222.

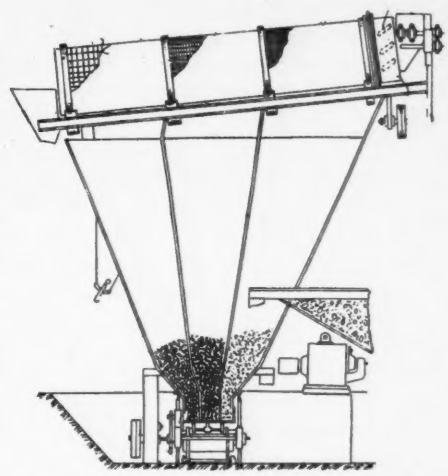
Gypsum in Cement.—Gypsum or other suitable material containing calcium salts is incorporated with cement clinker in two or three stages, 2% to 3% being added at each stage and ground thoroughly with the clinker. In this way a comparatively high percentage of gypsum can be added, reducing the setting time and increasing the compressive strength and yet reducing the volume expansion (Le Chatelier test). *British Patent* No. 247,097.

Feeding Ground Cement Powder to Kilns.—The question has arisen a number of times as to whether or not it is advisable to feed the ground mixture of limestone and cement rock to the kilns in the dry or moist condition. A number of comparative tests were made to determine just what effect the addition of water has on the manufacturing operations. The test was made to determine the consumption of coal used for burning the cement. It was found that the addition of water to the ground mass always had the effect of increasing fuel consumption. It was thus concluded that when the waste gases from the kilns are employed for the generation of steam in a waste-heat boiler, it is more advisable to feed the cement into the kiln in the dry state and take pains to clean out the boiler regularly each day to remove the cement dust that accumulates. When there is no waste-heat boiler then it is better to moisten the ground mass before burning both to prevent the formation of dust and because of the better color of the clinker. *Zement* (1926), 108.

Coloring Cement with Vegetable Dyes.—A new process for coloring cement has been proposed. The cement is mixed with a solution of the coloring matter which on exposure to air is readily thrown down as a permanent and insoluble coloring matter upon the surface of the cement particle.

The process, it is claimed, overcomes the principal difficulty of the powder method. Cement is so fine in texture that it is almost impossible to grind down any powder to a similar degree of fineness. The fragments of pigment, therefore, become dusted over with cement particles, which tend to obscure the color and to produce a greyish effect. By the employment of a solution of the coloring matter, which gives the pigment in the most perfect state of subdivision, precipitation actually occurs on the cement particles themselves. It also allows the proportion of coloring matter to be reduced to a minimum. Experiments have shown that satisfactory depths of color can be produced by the use of no more than two-tenths of a per cent of coloring matter, about 4½ lb. to the ton. *Chemical Age* (1926), p. 374.

Aggregate Mixing Apparatus. An arrangement of screens and partitioned hopper bin that is especially useful in proportioning aggregate of different sizes for concrete. The illustration shows the rotary sizing screen of three sections placed above a large hopper bin divided into three parts by partitions. The sized material drops into different bin sections and to the bottom. By setting the gate apparatus at the bottom varying amounts of these sizes may be drawn according to the aggregate mix desired.—*Zement*, **24** (423), 1926.



System of mixing different sizes of aggregate

Refractory Compositions from Portland Cement.—Portland cement is employed as a binding agent in the manufacture of refractory materials such as ground chamotte, quartzite, sandstone or siliceous sand or mixtures of these substances. The composition may be used directly to build up furnace linings and the like or it may be pressed into bricks, blocks, which do not require to be burnt. *British Patent* No. 247,994.

Bitumen Containing Cement Mixture. A mixture containing both bitumens and portland cement has been patented in Great Britain. This mixture consists of 6 to 9 parts of portland cement or the like, half to two parts of lime, half to one part of coal dust, 0.65 to 1.7 parts of bitumen, 0.1 to 0.3 part of asbestos, 0.1 to 0.25 part of soda and under certain conditions coloring matters as well. Liquefied asphalt, pitch and the like are added. British Patent No. 243,831.

Mortar-Making Properties of Anhydrite

Addition of Small Amounts of Lime or Portland Cement to Fine Ground Anhydrite Produces Good Mortar Material

By Dr. C. R. Platzmann, Berlin, Germany

(Translated by Margaret Arronet Corbin)

GYPSUM quarries are frequently handicapped by the occurrence of anhydrite deposits underlying the layers of gypsum—deposits which cannot be utilized in mortar-making any more than the overburned or dead-burned gypsum. It has often happened that the owner of a quarry had to interrupt or stop operations, not knowing how to do away with the anhydrite or having rapidly exhausted the gypsum and struck worthless anhydrite. The present article deals with the problem of utilization of anhydrite and is based on tests reproducing actual conditions. It aims to approach the ultimate solution which would be of utmost practical value.

Changes Occurring in Calcination of Gypsum Rock

As an introduction, let us briefly summarize a few points which are more or less generally known. The natural gypsum rock $CaSO_4 \cdot 2H_2O$ undergoes the following changes during burning:

Temperature Deg. C.	State
65	The rock begins to give off water of hydration.
101.5	The vapor pressure of gypsum reaches atmospheric pressure.
120–170	Gypsum changes to hemi-hydrate (plaster of paris).
190–200	Formation of dehydrated gypsum which rapidly absorbs water from the air and again forms hemi-hydrate. Practical utilization impossible due to rapid hydration.
200–500	No setting properties, overburned lumps of dehydrated gypsum.
Over 500	Formation of estrich gypsum; chemical composition identical with that of dehydrated and overburned dehydrated gypsum; behavior differs greatly from the latter, this phenomenon having thus far found no explanation.
850–900	Temperatures observed in the manufacture of estrich gypsum.
1000–1200	Dead-burned gypsum similar to natural anhydrite; hydration practically impossible, as it takes place at a very slow rate.

In using plaster of paris and dehydrated gypsum such as estrich gypsum we deal with a change back to the original state of dihydrate:

$$CaSO_4 \cdot \tfrac{1}{2}H_2O + 1\tfrac{1}{2}H_2O = CaSO_4 \cdot 2H_2O$$

$$CaSO_4 + 2H_2O = CaSO_4 \cdot 2H_2O$$

To retard the very rapid set of plaster of paris (10 to 20 minutes) 2 to 5% lime water is used in practice as well as admixtures of borax, alum or alcohol. The strength at 28 days of gypsum plaster yields the following approximate values:

	Compressive strength at 28days kg. per sq. cm.	lb. per sq. in.
Plaster of paris	80	1140
Estrich gypsum	180; max. 300	2550; max. 4250

Another factor may be mentioned here which, together with its slow rate of hydration, has thus far prevented the use of anhydrite in mortar, and that is its volume expansion of about 60% during setting.

Considering the above conditions, the German patent No. 312239 issued to F. Hartner, the former director of one of the Swiss cement plants during the war, and which originated due to his efforts to obtain sulphur from anhydrite, appears to be of exceptional importance. The process is based on the knowledge that dead-burned gypsum or anhydrite ground to an unusual degree of fineness—only 5% retained on the 4900-mesh sieve (about 175 meshes per lin. in.); plaster of paris to 10% retained on the 900-mesh sieve (about 75 meshes per lin. in.); dehydrated gypsum to 20-30% retained on the same sieve—will yield, with the addition of a few per cent lime or portland cement, an excellent hydraulic cementing material which hardens without the above-mentioned disadvantages of quick-setting properties or excessive volume expansion. In a test report published in *Zeitschrift fur Angewandte Chemie,* No. 56, p. 175, 1920, Hartner quotes the strength results shown in Table 1.

In view of the need of hydraulic cementing material, of the coal shortage of that time, and of the consequent lowering of efficiency of the German building industry, the author deemed it necessary to conduct some tests of anhydrite, obtainable on the German market as "Leukolith." These tests in general confirmed Hartner's results, yet differed from the latter in certain respects. Due to the importance of the subject, these tests appeared interesting enough to justify their publication.

Anhydrite, which is theoretically composed of 41.2% CaO and 58.8% SO_3, was purchased in the form of "Leukolith" and was used throughout the tests with a 3% admixture of portland cement. The chemical composition of "Leukolith" was as follows:

SiO_2	0.84%
Al_2O_3 and Fe_2O_3	0.48
CaO	40.95
MgO	0.80
SO_3	55.90
Ignition loss	1.35
	100.32%

TABLE 1—STRENGTHS OF ANHYDRITE MIXES REPORTED BY HARTNER

Mix	Quantity of Mixing Water	Age at Test	Tensile Strength kg. per sq.cm.	Tensile Strength lb. per sq.in.	Compressive Strength kg. per sq.cm.	Compressive Strength lb. per sq.in.
Neat	14%	3 days	20	284	200	2840
Neat	14	7	30	425	300	4250
Neat	14	28	50	710	450	6380
1-1	7	3	15	213	200	2840
1-1	7	7	20	284	300	4250
1-1	7	28	50	710	500	7100
1-2	6	3	12	170	180	2550
1-2	6	7	14	199	240	3410
1-2	6	28	28	397	320	4540
1-3	5	3	8	114	80	1140
1-3	5	7	10	142	110	1560
1-3	5	28	16	227	160	2270

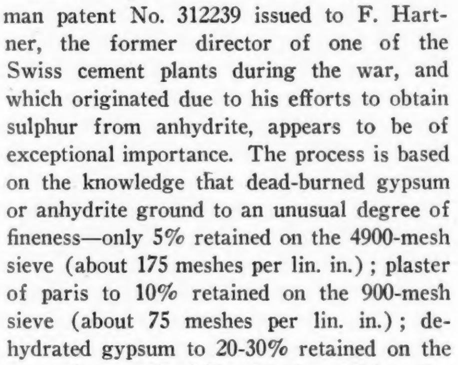


Fig. 1A

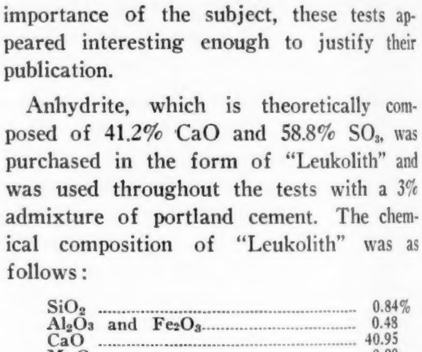


Fig. 1B

This analysis approaches the ideal composition very closely. It shows that a small percentage of cement was added to the substance.

The strengths obtained by the author at 7 days were slightly higher than Hartner's values; and at 28 days they were below the latter, yet were high enough to overlook this discrepancy. Average values of 3 tests are compiled in the table below.

TABLE 2—COMPRESSIVE STRENGTH OF ANHYDRITE PORTLAND CEMENT MIXES

Mix	Mixing Water	Age at Test	Average Compressive Strength kg. per sq.cm.	lb. per sq. in.
Neat	14%	7 da.	358	5080
Neat	14	28	407	5770
1-1	8	7	302	4290
1-1	8	28	348	4940
1-2	7	7	267	3790
1-2	7	28	276	3920
1-3	6	7	140	1980
1-3	6	28	110	1560

Additional tests were made with a 1-6 mix, which, however, yielded unfavorable results, as the low strengths—18 kg. per sq.

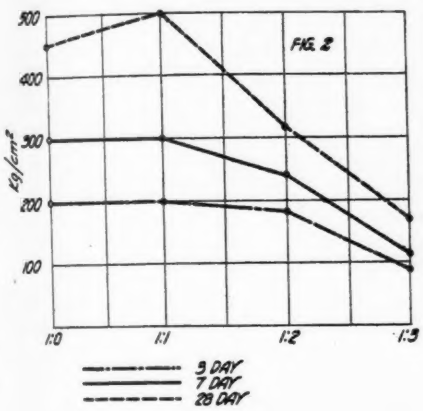


Fig. 2

cm. (256 lb. per sq. in.) at 28 days—made all practical uses impossible. The standard sand, as specified for tests of portland cement, was used throughout these tests to obtain uniform results. The values of Tables 1 and 2 are plotted in Figs. 1a and 1b. Figs. 2 and 3 show the drop in strength in Hartner's and in the author's tests due to increasing leanness of mix.

The important and new knowledge gained from the author's tests was that satisfactory results could be obtained only when the quantity of mixing water indicated in the tables was gaged precisely, the strengths obtainable dropping considerably even for a 1% deviation from these values. To illustrate this variation, further tests of neat "Leukolith" were made, using alternately a very high (20%) and a very low (10%) quantity of mixing water. The results are given in Table 3 (see also Fig. 4):

TABLE 3—STRENGTHS OBTAINED WITH GAGED AMOUNTS OF MIXING WATER

Mix	Mixing Water	Age at Test	Average Compressive Strength kg. per sq.cm.	lb. per sq. in.
Neat	20%	28 da.	297	4220
Neat	10	28	169	2400

Aside from being considerably lower, the results become erratic (320, 278, 310; 176, 194, 136). It is assumed that the difference between Hartner's and the author's results is due mainly to the high sensibility of anhydrite to minute changes in quantity of mixing water, which naturally complicates its practical uses.

It may seem strange that 20% mixing water reduces the strength, while according to the equation of hydration,

$$CaSO_4 + 2H_2O = CaSO_4{\cdot}2H_2O$$

26.5% water is required to complete the theoretical reaction. This is explained by the fact that due to varying sizes of particles only a part of the cementing material becomes hydrated. Similar observations have been made for lime and cement.

Finally, tests were made with anhydrite to produce a lightweight gypsum concrete, using sand and coke cinders as aggregates. However, a 1-2-3 mix yielded compressive strengths not over 13 kg. per sq. cm. (185 lb. per sq. in.).

The great importance of anhydrite as a mortar ingredient consists not so much in the possibility of using leaner mixes as in the low fuel consumption (6% to 10%) involved, as all other material such as lime and cement requires higher fuel consumption for calcination alone:

Plaster of paris	8% coal / 14% lignite	Computed for burned product
Lime	25% coal	
Portland cement	17-23% coal	

In other words, the relative cost of the manufacture of anhydrite is low and justifies its use in richer mixes.

As these tests aimed to reproduce conditions of actual practice, it is impossible at this time to advance an explanation of this behavior of anhydrite contradicting all previous experience, but it may be assumed to be dependent on the degree of fineness—5% retained on the 4900-mesh sieve.

Increasing fineness of particles increases the surface and raises the affinity and activity of the particles. The investigations in the field of colloidal chemistry have led us to the conclusion that no sharp limits exist between mechanical division, colloidal and molecular solutions, and that we are dealing here with disperse systems whose physical and chemical character is not uniform. According to Ostwald, the degree of dispersion increases as follows:

Coarse suspension → Colloids → Molecular Solutions

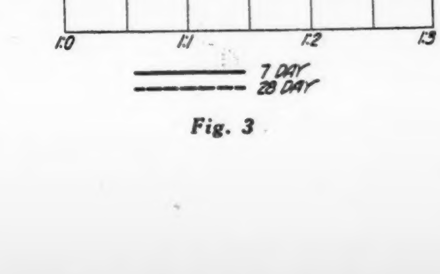


Fig. 3

Increased fineness alters the equilibrium of a system in the direction of the arrows. When we succeed in raising the proportion of colloidal particles, the affinity, cementing value and activity are raised simultaneously. It is assumed that for practical purposes the arbitrarily selected limit between colloids and mechanical division corresponds to a size of 0.0001 mm. It is clear that by far the greater part of anhydrite does not reach this size; however, its fineness permits a transformation in the direction of the arrows.

Another point should be emphasized here. The marked drop in strength with increasing leanness of mix (see Figs. 2 and 3) shows conclusively that the aggregates do not take part in the physical and chemical changes during the hardening process, and complicate the reaction only mechanically.

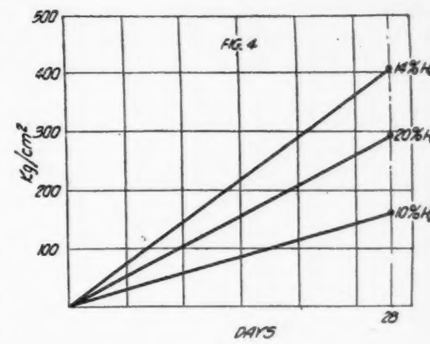


Fig. 4

The problem of the utilization of anhydrite is not new; it has been made the subject of numerous tests. Here is one way—there may be others in time—which has even today led to noteworthy results, without altogether removing all obstacles to practical uses of anhydrite.

The utilization of anhydrite is as important to the practical man, the owner of a quarry, or the builder, as it is to the scientist. Within the limits of insufficient yet enlightening test evidence, this article can be but an outline of this subject.

Bituminous Coal Fields of Pennsylvania

THE Pennsylvania Topographic and Geologic Survey have recently issued a new bulletin, M-6, containing a detailed description of the bituminous coal fields of Pennsylvania. To obtain material for this work several hundred mines in various localities were visited and the physical characteristics of the coal observed. In addition much data furnished by state mine inspectors is included in the report.

The chief interest in this survey for rock products operator lies in the fact that he can obtain definite information on coals that lie in certain localities.

Hints and Helps for Superintendents

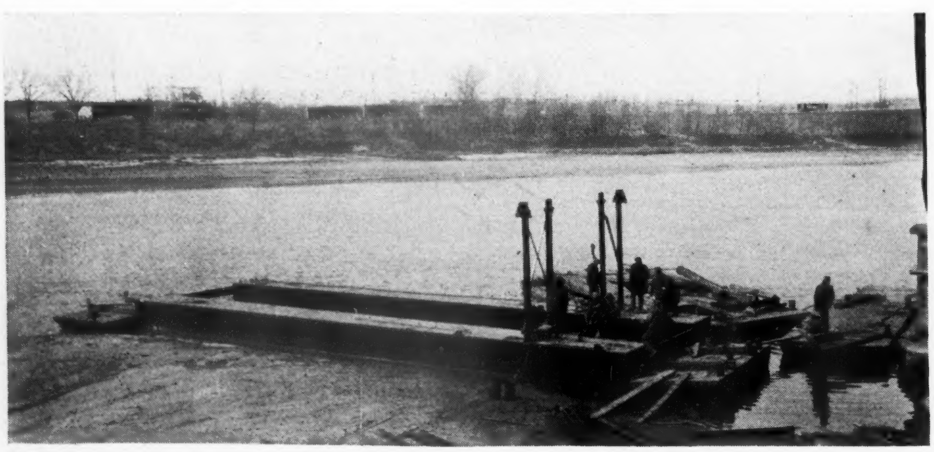
A Special Pontoon for Holding the Cutter of a Dredge

THE cutters, such as the traveling suction screen, used with pump dredges, are heavy and have to be provided with another method of support than the ordinary A-frame and boom by which the suction pipe is raised and lowered. The usual method is to use two small pontoons which are connected to the dredge by timbers. These support one end of the cutter while the dredge holds the other. The weight is thus divided between the dredge and the pontoons.

Even this half of the weight usually calls for some balancing of the dredge hull, especially if the hull was designed to be used without a cutter. As the cutter is raised and lowered there is some effect on the dredge hull due to the change in position of the cutter.

A pontoon which is designed to carry the entire weight of the cutter and suction, so that there will be no strain put upon the dredge hull in any position, is shown in the accompanying picture. In operation it is lashed to the front of the dredge hull. This lashing and the flexible rubber hose that connects the suction pipe to the suction of the pump are the only connections between the dredge and the cutter.

The pontoon and cutter may be taken from one dredge and used on another dredge without any changes in the dredge and with no more work than lashing the pontoon and coupling on the suction pipe. In a word, the pontoon and cutter form an independent unit which may be attached to or detached from any dredge at pleasure. The pontoon is solidly built of steel and carries the necessary framework for raising and lowering the cutter and suction. It has been built by the Stewart Sand Co., of Kansas City, Mo. and is in use at one of the plants.



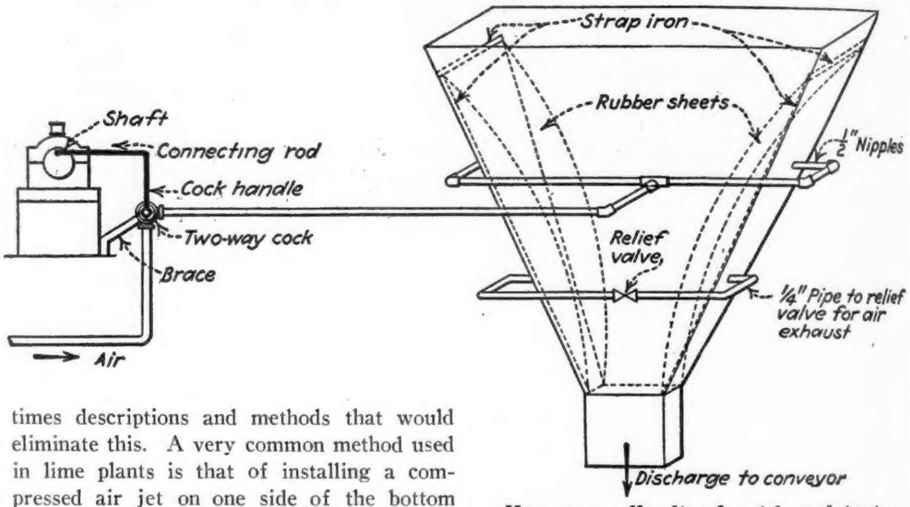
Pontoon which carries the entire weight of the cutter and suction and eliminates strain on the dredge hull

Preventing Bridging in Chutes and Hoppers

IN handling very fine material like hydrated lime, portland cement and pulverized limestone, many plant superintendents frequently have difficulty from the material bridging or packing in the bins and not flowing freely. In this section we have published at various times descriptions and methods that would eliminate this. A very common method used in lime plants is that of installing a compressed air jet on one side of the bottom of the bin which feeds the sacker. The air "lubricates" the particles so that they slip on each other and the material thus flows easily.

An unusual and interesting device accomplishing the same purpose (only for borax in place of cement, etc.) appeared in a recent issue of *Chemical and Metallurgical Engineering*. It was devised by M. C. Cockshott, and, describing its operation, he says:

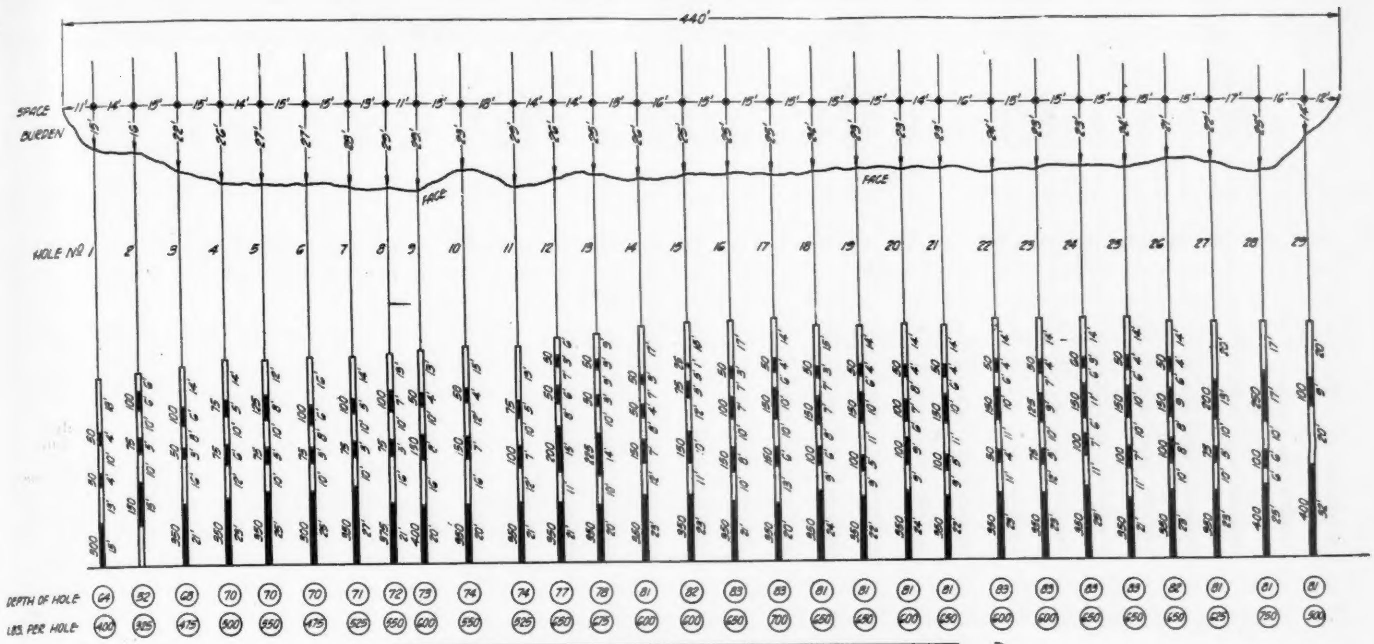
"After much unsuccessful experimenting with different smooth materials for lining the sides of the hopper I hit on the idea of a palpitating air cushion and one was constructed, as can be seen in the accompanying figure, as follows: The hopper was remodeled so that it had but two pitched sides, the other two being vertical. These sides were covered with a loosely fitting lining of thick sheet rubber, attached at the edges with thin strap iron and stove bolts, so that a leakproof air cushion was formed. In the outside of the center of each sloping side of the hopper a ½-in. pipe nipple was welded and the two were connected with a pipe header. Also, ¼-in. nipples were welded in near the bottom edge, and these also connected with a header. A small relief valve was connected to the ¼-in. line, relieving to the atmosphere.



Hopper walls lined with palpitating air cushions permit the easy flow of fine materials

"For the inlet, a two-way cock was set up at some distance away, where power to operate it was available from a convenient line-shaft. This shaft had a stub end that projected from a hanger bearing, which was converted into a crank, as shown in the figure, by drilling in its end a ¼-in. hole about 1 in. off center. A tap bolt was screwed into this hole to serve as the crank pin. To connect this to the cock, an extension handle was made from a piece of bar, one end being upset and a square hole broached in it to take the end of the plug of the two-way cock and the other connected to another short bar with a hole in the opposite end, of such a diameter that the tap bolt was an easy fit. This bar was in reality a connecting rod by means of which the rotary motion of the shaft was changed into a reciprocating motion at the cock handle.

"It was necessary to adjust the stroke by means of the tap bolt, several more holes being drilled in the shaft end. The angularity of the rod also had to be adjusted. These adjustments, coupled with a correct



COLUMBIA QUARRY CO. QUARRY NO. 1 KRAUSE ILL. NOVEMBER 30, 1925		
NO. OF HOLES 29 LENGTH OF SHOT 440' AVERAGE DEPTH 77.6' AVERAGE BURDEN 23.8' TOTAL TONNAGE 62,653 DYNAMITE USED 338½ CASES 5×24-60% TOTAL LBS. DYN. 16,925	COST OF DYN. $2834.95 2500' C. CORDEAU 110.00 460' PLAIN CORDEAU 18.40 TOTAL COST $2963.35 COST PER TON $.047 62653/2963.35 TONS PER LB. DYN. 3.7 16925/62653	DATE BLASTED NOV. 30, '25-11 A.M. WEATHER CLEAR AND COOL SHOT FIRED WITH FUSE SECONDARY BLASTING CASES X % CASES X % TOTAL COST

Complete record for a quarry blast

setting of the relief valve, made it possible to obtain a fairly steady pulsation or palpitation of the rubber sheets. The weight of the falling borax was sufficient to expel the air, and the force of the entering air, when the cock was opened, expanded the cushion, which was thus kept in a state of continual motion. Abrasive action on the cushions was slight, one set lasting over three months in constant service, while the cost of renewal was so small as to be practically negligible."

Stop—Look—Listen!

MANY accidents occur around rock products plants from the proximity of buildings and stairways to railway car-loading tracks. Safety-first in accident prevention demands the exercise of due caution in crossing the tracks. Signs may help, but they *do not insure* caution.

The illustration herewith shows how the Lehigh Portland Cement Co. insures caution at its new Sandt's Eddy (Penn.) plant. Access to the mill crusher house, power house and other buildings, from the office and highway is by means of a concrete stairway, the foot of which opens directly on the railway spur for setting in and taking out cars at the packing plant.

Not depending on a sign "Stop—Look—Listen" to keep men from plunging down the stairway across the track, a double rail fence has been erected at the foot of the stairs so that a man must of necessity slow up and take a reverse turn around both ends of the railing in order to get out on the tracks. While he is doing this, he has ample opportunity to determine whether or not a train is approaching.

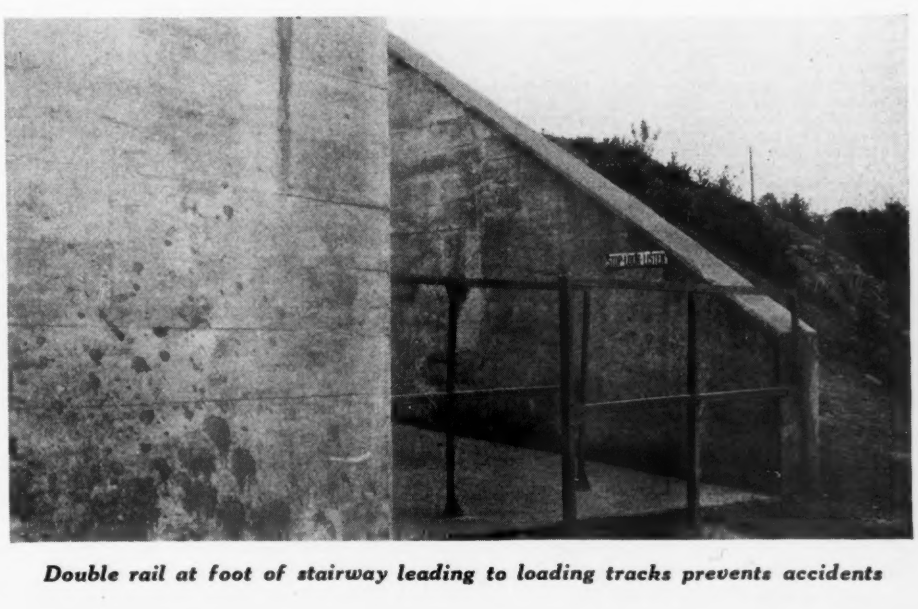
Maj. Henry A. Reninger is in charge of safety work for the Lehigh Portland Cement Co. and "Jimmie" Gish is superintendent of the Sandt's Eddy plant.

Attention, Superintendents!

This department offers $5 and a copy of the new 128 page booklet containing over 150 valuable hints and helps selected from ROCK PRODUCTS issues of the past few years, to any reader submitting a good idea that can be used as a hint and help. It may be a photo or a rough sketch accompanied by a few explanatory words. In fact, anything that will help solve the little difficulties that crop up in rock products plants, will do. Send us your ideas. You may be a winner!

Efficient Blast Records

THE Columbia Quarry Co., St. Louis, Mo., uses a method of keeping cost and detail record of blasts which many quarry operators would find profitable in duplicating. The entire story from the number of holes, spacing, powder charges, etc., is put in permanent form on a tracing and thus makes a complete record for that blast. The diagram shown is reproduced from a blueprint made from such a tracing and represents an actual blast made at quarry No. 1, Krause, Ill. Such records are valuable not only for the cost data they contain but by examination of the different sections of the quarry face after the blast, they help the Columbia company to check up on the particular efficiency of the charge at those points. Another advantage is that *everything* pertaining to the blast is on one sheet, enabling the superintendent or other officials to obtain full information very rapidly and easily.



Double rail at foot of stairway leading to loading tracks prevents accidents

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	July 20	No par	44	45½	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	July 20	100	115	...	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	July 20	No par	34	34½	45c qu., 15c ext. July 1
Atlantic Gypsum Products Corp.[10]	July 19	100	99	101	
Atlas Portland Cement Co. (common)[2]	July 20	No par	45	47	50c quar. Mar. 1
Atlas Portland Cement Co. (preferred)	...	100	...	...	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	July 20	33⅓	43	46	2% quar. July 1
Bessemer Limestone and Cement Co. (common)[4]	July 19	100	130	135	1½% quar. June 30
Bessemer Limestone and Cement Co. (preferred)[4]	July 19	100	106½	108	1¾% quar. June 30
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	July 19	...	115	125	8% annual
Boston Sand and Gravel Co. (common)[10]	July 17	100	60	63	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	July 3	...	...	83	1¾% quar. July 1
Boston Sand and Gravel Co. (1st preferred)[10]	July 3	...	...	95	2% quar. July 1
Canada Cement Co., Ltd. (common)	July 20	100	107⅞	108	1½% quar. July 16
Canada Cement Co., Ltd. (preferred)[11]	July 16	108	114	115	1¾% quar. Aug. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	July 16	...	102	103	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	July 16	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	July 19	No par	22½	24½	50c quar. July 12
Charles Warner Co. (preferred)	July 19	100	99¼	103	1¾% quar. July 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	July 17	100	103	105	
Cleveland Stone Co. (new stock)	July 20	...	55	57	1½% quar., June 1, 1% ex. June 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	July 16	100	104	...	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	July 21	...	95	98½	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	July 21	100	98	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	July 16	100	99	101½	
Dexter Portland Cement Co. (6% serial bonds, 1935)[23]	July 19	...	97	...	
Dolese and Shepard Co. (crushed stone)[7]	July 21	50	89	91	$1.50 quar. July 1, $1 ex. July 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	June 21	97	101	...	1¾% quar. July 1
Egyptian Portland Cement Co. (common)[21]	June 21	18	20	...	40c quar. July 1
Egyptian Portland Cement Co. (warrants)[21]	June 21	10	15	...	
Giant Portland Cement Co. (common)[2]	July 20	50	41	...	
Giant Portland Cement Co. (preferred)[25]	July 20	50	48	50	3½% s.-a. June 15
Ideal Cement Co. (common)	July 20	No par	70	72	$1 quar. July 1
Ideal Cement Co. (preferred)[6]	July 17	100	107½	108½	1¾% quar. July 1
International Cement Corporation (common)	July 20	No par	56½	56¾	$1 quar. June 30
International Cement Corporation (preferred)[2]	July 19	100	105	105	1¾% quar. June 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	...	30	45	
Kelley Island Lime and Transport Co.	July 20	100	121	121½	$2 quar. July 1
Lawrence Portland Cement Co.[2]	July 20	100	100	110	2% quar.
Lehigh Portland Cement Co.[6]	July 20	50	85	87	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	July 16	100	99½	100½	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	July 16	100	97	99	
Michigan Limestone and Chemical Co. (common)[6]	July 20	...	24	26	
Michigan Limestone and Chemical Co. (preferred)[6]	July 17	...	23	...	1¾% quar. July 15
Missouri Portland Cement Co.	July 20	25	57½	58	25c quar. May 31, 25c ex. May 31
Monolith Portland Cement Co. (common)[9]	July 16	...	11	11½	
Monolith Portland Cement Co. (units)[9]	July 16	...	27	28	
Monolith Portland Cement Co. (preferred)[9]	July 16	...	8	8¼	
Nazareth Cement Co.[20]	July 17	No par	38	40	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	July 19	...	115	135	
New England Lime Co. (Series A, preferred)[14]	Jan. 29	100	96½	99	
New England Lime Co. (Series B, preferred)[22]	July 17	100	92	96	
New England Lime Co. (V.T.C.)[22]	July 17	...	35	38	
New England Lime Co. (6s, 1935)[14]	July 3	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	July 20	...	97½	97½	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	July 17	...	94	99	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	July 20	...	18	20	
North American Cement Corp. (preferred)	Dec. 31	...	...	...	1.75 quar. Aug. 1
Pacific Portland Cement Co., Consolidated[5]	July 2	100	82½	83	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	July 2	...	99½	101¼	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	July 19	10	5¼	6	
Petoskey Portland Cement Co.[1]	July 19	10	9¼	9¾	1½% quar.
Rockland and Rockport Lime Corp. (1st preferred)[10]	July 3	100	98	98	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[10]	July 3	100	...	...	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[10]	July 19	No par	45	45	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	July 7	100	106	135	$2 quar. Apr. 1
Santa Cruz Portland Cement Co. (bonds)[5]	July 2	...	105⅛	...	6% annual
Santa Cruz Portland Cement Co. (common)[5]	July 2	50	82½	...	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (Class A)[20]	July 17	...	42¾	43¾	
Superior Portland Cement, Inc. (Class B)[20]	July 17	...	20½	21½	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	July 16	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	July 16	100	96	99	
United States Gypsum Co. (common)	July 20	20	165¼	168½	2% quar., $1 ex. May 31
United States Gypsum Co. (preferred)	July 18	100	118	...	1¾% quar. June 30
Universal Gypsum Co. (common)[3]	July 21	No par	15	15½	
Universal Gypsum V.T.C.[3]	July 21	No par	14½	15½	
Universal Gypsum Co. (preferred)[3]	Aug. 5	...	76	...	1¾% quar. Sept. 15
Universal Gypsum Co. (1st Mortgage 7% bonds)[3]	July 21	...	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds)[18]	July 16	100	99	101½	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	July 22	100	98½	100	
Wolverine Portland Cement Co.	July 19	10	6	6	2% quar. Aug. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by De Fremery & Co., San Francisco, Calif. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25] A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 70

Editorial Comment

No Western Rate Increase

We rejoice with Western sand, gravel and crushed stone producers that they will not have to shoulder either a 7½ cents per ton or a 5 per cent increase in freight rates. Because of the very effective work done by the National Sand and Gravel Association and the National Crushed Stone Association in cooperation with other national associations of producers and shippers, the Interstate Commerce Commission is persuaded that the general 5 per cent increase for the Western railways is not justified at this time. Therefore, the very considerable investment made by the members of these national associations is more than justified, and the actual saving to producers and shippers is very considerable, not so much from the difference in freight rates, which could have been passed on to the consumer, but from the disorganization and subsequent realignment and loss of business that would have been occasioned by the proposed rate changes.

Moreover, it should not be lost sight of that the hearings held and the testimony taken will probably be the deciding factors in any changes in the basic freight rate structure of the entire country, which the Interstate Commerce Commission has up for decision at some future time. It was not a sectional rate hearing wholly, but a fundamental investigation of the rates and the basis of rates on all commodities.

In the recent decision of the Interstate Commerce Commission against a general 5 per cent increase in Western territory there is no means of weighing the part played by the two mineral aggregate associations, since they were merely two of many trade organizations which opposed the increases, as well as practically every state public service commission and commercial organization in the territory affected.

But in the decision to come on changes in the basic rate structure the real effectiveness of the work done by the two associations will be valued in relation to the work of other organizations, for then there will be presumably a separation of the sheep from the goats, and rates will be readjusted commensurate with an equitable distribution of the freight cost burden and the ability of various commodities to carry higher proportional rates than others.

There is little prospect that such a decision will be reached in the near future, or that it will be reached without further discussion and further pressure by those most interested in rate reductions—but sand, gravel and crushed stone producers may well feel proud of the work accomplished and may feel considerable assurance that they have not as yet reaped the full value of their "planting." Their testimony of record will not only bear fruit in this future consideration of the whole basic rate structure, but in a thousand and one cases of local controversy, the way for which is now specifically opened by the Interstate Commerce Commission in the refusal of a general increase.

A New Association Service

Judging by a circular letter from the office of the National Crushed Stone Association, dated July 7, 1926, and addressed specifically to *associate members*—that is, the 70-odd machinery and equipment manufacturers who serve the quarry industry—A. T. Goldbeck, director of the association's bureau of engineering, has illustrated something that so far as we know is unique in trade association activities. With the letter is enclosed a circular of the United States Department of Commerce outlining trade opportunities for these machinery and equipment manufacturers in Central and South America. In his letter Mr. Goldbeck says: "During the past few years there have been several very important commissions visiting this country looking into our methods of road building and equipment used for road building and allied industries. A number of you might be interested in securing South American trade and I would suggest that you send for Bulletin No. 418 mentioned in the accompanying circular."

Undoubtedly most live machinery and equipment manufacturers had received the same material through associations in their own line or through trade periodicals devoted to their lines of manufacture; it is not so much the value of the service rendered as the spirit behind it. Most machinery manufacturer auxiliaries of national material men's associations are regarded as necessary parasites—reputed to be all too ready to take away any profits the material men may accumulate, but whose financial assistance in association work has to be more or less recognized. Here we have a specific recognition of the machinery men as a part of the organization, and evidence of a genuine desire to render them the same kind of helpful service in promoting sales that active members receive—a service that has many opportunities for growth and expansion.

We are sure the associate members of the National Crushed Stone Association thoroughly enjoy being thus recognized as legitimate members of the firm rather than as parasites; and we share that joy because we honestly feel that Rock Products has been an active and influential factor in bringing about that feeling of fraternity which exists so eminently in the National Crushed Stone Association between active and associate members—between sellers of machinery and equipment and their customers—in the promotion of the common cause of the most prosperity for *all*.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	....	12½	....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	....	70	....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	....	
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	....	$12 for the lot	....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	....	$66 for the lot	....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	....	....	£1⅝	
Phosphate Mining Co. (1)	Nov. 25	....	1@5	....	
Pittsfield Lime and Stone Co. (preferred)	....	100	....	....	2% quar. Apr. 1
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	....	$200 for the lot		
Rock Plaster Corp. (390 sh. com., no par) (1)	Mar. 17	....	$12 for the lot	....	
Simbroco Stone Co. (pfd.)	Dec. 12	....	....	....	$2 Jan. 1
Tidewater Portland Cement Co. (common) (3)	Nov. 25	....	8½	....	
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (2)	Dec. 30	....	$1 for the lot	....	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	....	10c	....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925.

Prospects of Best Second Quarter for International Cement

EARNINGS of the International Cement Corp. for the second quarter ending June 30 will probably be the largest for any similar period in the history of the company. In the second quarter of 1925 net earnings amounted to $1,110,000, equal to $1.86 a share on the 500,000 shares of common stock now outstanding. This established a record for second quarter earnings and was the second largest net ever reported for a three months' period. It is expected that net earnings for the current three months will be somewhat larger although definite figures are lacking.

Operations in the first quarter and the early part of the second quarter were considerably hampered by the abnormal weather conditions which prevailed. Excessive rains curtailed production and materially reduced the working days in many of the plants located in the United States. The amount of unfilled orders on the company's books at the present time is larger than usual at this time of the year and all of the company's plants are in operation. One plant which was closed for a part of the winter resumed operations in April and is operating at a satisfactory rate.

The outlook generally continues good in the cement industry. Building permits are running ahead of 1925. There is believed to be some recession in permits to the small builders but the effect of this on the total is small. Road building continues at high levels. The depression predicted for this spring in many quarters for cement and other industries furnishing building materials obviously has not arrived.

At the time of the formation of International Cement a definite plan was formulated for overcoming the seasonal character of the cement industry. Approximately 60% of the annual cement shipments for the United States as a whole are made in five months of the year. In the northern part of the United States the season is necessarily shorter than the southern part, where, particularly in the extreme South, the shipping season extends over the entire year. With southern as well as northern properties the average season of International's properties in this country is lengthened. The Cuban mill ships during practically the entire year. The season of the Uruguay and Argentine plants offsets the winter season of the northern mills. This has the effect of keeping the rate of shipments at a more constant level throughout the year.

Productive capacity has been increased in every year since incorporation in 1919 and at the end of 1925 was more than four and one-quarter times the 1919 showing. Net earnings in 1925 amounted to $3,518,462 or $7.03 a share on the 500,000 common outstanding. The balance available for the common stock in 1925 was nearly 11½ times the 1919 balance.—*Wall Street News* (New York City).

McGrath Sand and Gravel Bonds Offered

WILLIAM R. COMPTON & CO., Chicago, Ill., are offering at 99 (to yield about 6.60%) $250,000 McGrath Sand and Gravel Co., Lincoln, Ill., first mortgage 15-year 6½% sinking fund bonds dated June 1, 1926, due June 1, 1941. Total authorized issue, $500,000. Principal and semi-annual interest June 1 and December 1, payable at the American Trust Co. in St. Louis, Mo. Coupon bonds in the denominations of $1,000, $500 and $100 each.

James McGrath, president of McGrath Sand and Gravel Co., summarizes his accompanying letter as follows:

History.—The McGrath Sand and Gravel Co. was incorporated July 9, 1917, with capital stock of $100,000 and this company is the successor to the Mackinaw Sand and Gravel Co., which was originally organized in 1910 and incorporated March 24, 1914, with a capital stock of $25,000. The original company operated a small gravel pit at Mackinaw, Ill. Practically all of the expansion has been made possible by the reinvestment of earnings in the properties. The company's plants are now located at Mackinaw, Pekin (two plants), Chillicothe and Forreston, Ill. In recent months the company has obtained, through stock ownership, complete control of the Flesher Sand and Gravel Co., located at Shawneetown, Ill. The location of the properties of the com-

McGRATH SAND AND GRAVEL CO.—BALANCE SHEET, DECEMBER 31, 1925
(After giving effect to proposed financing in the certificate appended hereto)

Assets		
Gravel lands, buildings, machinery and equipment	$1,257,077.57	
Less reserves for depletion and depreciation	204,061.27	
Net book value		$1,053,016.30
Investments:		
Subsidiary company (60% of outstanding capital stock), par value	$ 55,000.00	
Bonds—payment of 10% on subscription to $500.00, par value	50.00	
Total investments		55,050.00
Current Assets:		
Cash	$ 20,876.92	
Notes receivable	1,821.96	
Accounts receivable:		
Customers' (less reserve of $4,000.00)	105,557.63	
Sundry debtors	6,698.09	
Total current assets		134,954.60
Deferred charges (Discount and expense on first mortgage, 6½% bonds, advance payments on stripping contracts, and prepaid expenses)		39,808.69
TOTAL		$1,282,829.59
Liabilities		
First mortgage, 15-year, 6½%, sinking fund bonds, due June 1, 1941, authorized	$ 500,000.00	
Less unissued	250,000.00	
Outstanding		$ 250,000.00
Notes payable, due $1,000.00 annually, commencing January 15, 1927		15,000.00
Current liabilities:		
Accounts payable	$ 24,026.35	
Accrued real estate and personal property taxes	2,841.83	
Total current liabilities		26,868.18
Reserve for federal income taxes		18,190.33
Capital:		
Capital stock—Authorized 10,000 shares of $100.00 each; outstanding 8,330 shares	$ 833,000.00	
Surplus	139,771.08	
Total capital		972,771.08
TOTAL		$1,282,829.59

pany have been selected so as to enable it to ship sand and gravel to all parts of the state of Illinois (except the immediate Chicago territory) at very favorable freight rates. The company's business also extends into southern Wisconsin, eastern Iowa and western Kentucky. The buildings, machinery and equipment at the five plants of the company have been appraised by Lloyd-Thomas Co. of Chicago as having a sound or depreciated value of $504,659.37 as of April 1, 1926. The gravel property of the company has been appraised by Lloyd-Thomas Co. as having a present value of $2,638,606.50. It is estimated that the gravel deposits of the company contain sufficient material to last the company, at the present rate of consumption, for over forty years.

Business.—The operations of the company consist of mining gravel and sand. It is classified and the total output is evenly distributed among dealers, contractors, builders, railroads and road contractors. The company is protected in its accounts receivable by means of mechanics' liens and over a period of 15 years its credit losses have been less than ¼ of 1%.

Security.—The first mortgage 15-year 6½% sinking fund bonds constitute the sole bonded indebtedness of the company and will be secured, in the opinion of counsel, by a direct first mortgage on the land, buildings, machinery and equipment of the company. These properties were appraised by Lloyd-Thomas Co. of Chicago as of April 1, 1926, at a depreciated value in excess of $3,000,000. The mortgage will cover the fixed assets of the company now owned and hereafter acquired. The $250,000 bonds now to be issued are part of a total authorized issue of $500,000.

Provisions.—The mortgage deed of trust provides, among other things, the following:

1. None of the additional $250,000 bonds may be issued except to purchase property or to make improvements thereon at not exceeding 75% of the true market value or cost thereof, and then only if the sound or depreciated value of the fixed assets of the company are in excess of 300% of the bonds outstanding and to be issued.

2. None of the additional $250,000 bonds may be issued unless the average net earnings for the two fiscal years immediately preceding the issuance of any additional bonds have been at the average rate of at least four times the minimum interest charges on the bonds outstanding as well as those to be issued.

3. No cash dividends shall be paid on the common stock when such payment will reduce the ratio of current assets to current liabilities below 200%.

4. The establishment of a sinking fund into which payments will be made to the trustee monthly of 2½ cents per ton on all sand and gravel mined up to 750,000 tons with a minimum of $18,500 per annum and on any quantity of sand and gravel mined in excess 750,000 tons during any one year, it will set aside 1½ cents per ton.

In the last five years the average production of the company has been well over this figure of 750,000 tons. This sinking fund will be used for the retirement of these bonds and is calculated on the above basis to retire the entire issue before maturity.

Earnings.—Net sales and net earnings available for interest, after depreciation, depletion and federal taxes, for the four years ended December 31, 1925, as audited by Messrs. Haskins and Sells, certified public accountaints, were as follows:

	Net sales	Available for interest after deducting depreciation, depletion and taxes
1922	$354,568	$ 99,625
1923	561,030	113,450
1924	661,918	109,167
1925	611,076	105,609

The average net earnings available for interest after depletion, depreciation and federal taxes are more than six and one-half times the maximum annual interest requirements of this issue and over three times the estimated interest and sinking fund requirements. The increase in earnings which it is estimated will result from the extension and acquisition of plants and additional properties are not reflected in the above statement.

According to the company's balance sheet issued and based on an audit of the company books as of December 31, 1925, by Messrs. Haskins & Sells and adjusted to reflect the result of this issue of $250,000 first mortgage 15-year 6½% sinking fund bonds, the total net assets after deducting all liabilities other than these bonds amounted to $1,182,962.39, or approximately $4,731.84 per $1,000 bonds.

Capitalization.—Upon completion of this financing the company will have the following capitalization:

	Authorized	Outstanding
First mortgage bonds	$ 500,000	$250,000
Common stock	1,000,000	833,000

Purpose of Issue.—The proposed bond issue will be used for the retirement of outstanding indebtedness, enlarging operation of present plant, the purchasing of additional gravel property, and other corporate purposes.

Management.—James McGrath has served as chief executive officer since the inception of the business in 1910. The other executives have likewise been associated with the company since its start. No change in management is contemplated.

Cement Merger Plans Bond Issue

CONFIRMATION of the consolidation of the Dexter Portland Cement Co., with plants at Nazareth and Penn Allen, Penn.; the Clinchfield Portland Cement Corp., with plants at Kingsport, Tenn., and Perry, Ga.; the Dixie Portland Cement Co. of Chattanooga and the Pennsylvania Portland Cement Co. of Bath, Penn., into one corporation to be known as the Pennsylvania Cement Co., has been made known by John A. Miller, president of the Dexter company and who will head the new company. The total value of the property and holdings of the companies entering the merger is set at about $40,000,000 and the combined output at about 10,000,000 bbl. per year. It is expected that there will be a bond issue underwritten by various bankers and a public offering made at an early date. According to reports the new company will have a capitalization of $41,000,000 of which $13,000,000 will be in bonds, $13,000,000 in preferred stock and 400,000 shares of common stock at $37.50 per share.

The shares of the four companies are closely held and are not listed on exchanges. Latest figures available show that the Dexter company has $1,984,000 of common and a small amount of preferred stock outstanding. In January the directors authorized an issue of $2,000,000 6% bonds, due 1926 to 1934. These constitute the company's sole funded debt and were issued to provide funds for the acquisition of the Penn-Allen Cement Co. The Nazareth plants of the Dexter company are said to have appraised at $8,000,000.

The Dixie company has $1,024,200 preferred and $2,000,000 common stock outstanding. Local stockholders in the Dixie company, it is reported, will get under the merger plan, $280 per share for their stock, which means a valuation of approximately $8,000,000 for the properties.

The Pennsylvania Cement Co. (the old company) has $1,250,000 outstanding in stock and no bonded indebtedness.

Part of the proceeds of the proposed merger bond issue will be used to build a seven-mile railroad between Chattanooga and Perry, Ga.—*Philadelphia (Penn.) Public Ledger.*

International Cement Common Stock Offering to Stockholders

INTERNATIONAL CEMENT CORP., New York, is offering stockholders the right to subscribe to 62,500 shares of additional common stock at $50 a share in the ratio of one share for each eight shares held. This offer is being made to stockholders of record July 27, and expires August 11. The proceeds of this sale will be used to finance in part an expansion program completed and to be completed of approximately $5,000,000. Upon the completion of this program the company will have a potential capacity of 14,000,000 bbl. carried on its books at an approximate net plant and property value of $2.30 per barrel.

In letter to stockholders, F. R. Bissell, chairman, states:

"In June, 1925, the company through sale of preferred and common stock financed the purchasing of the Indiana and Alabama plants and New Orleans plant site.

"Since then the company has added and is adding to its investment in plant facilities by the construction of the New Orleans plant, which is now under way; a third kiln unit and equipment in the Argentine plant; a complete and modern packing and storing plant in Buenos Aires; a third kiln unit with equipment at the Uruguayan plant; the building of a modern packing and storage plant at Havana, Cuba, and additional kiln units with necessary grinding and power equipment at the Cuban plant and additions and improvements at the various other plants in the system.

"The directors feel that, in accordance with the previous practice, it is sound business to finance part of this program through the medium of permanent capital, and part through earnings.

"Warrants covering the rights will be forwarded to stockholders as soon as practicable after July 27."—*Wall Street Journal.*

Portland Cement Output in June

Record Production and Shipments—Total for Half Year Exceeds That of Last Year

JUNE production and shipments of portland cement were the greatest for any month in the history of the industry, according to the Bureau of Mines, Department of Commerce. Shipments increased almost 9% and production 1,440,000 bbl. over that of June, 1925. Shipments and production for the first half of 1926 are the highest ever recorded in the history of the portland cement industry. Portland cement stocks continued the seasonal decline but at the end of June were nearly 16% higher than on June 30, 1925. These statistics, prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines, are compiled from reports for June, 1926, received direct from all manufacturing plants except two, for which estimates were necessary on account of lack of returns. Another new plant, located in California, is included for the first time in the statistics.

Clinker Stocks

Stocks of clinker, or unground cement, at the mills at the end of June, 1926, amounted to about 10,088,000 bbl. as compared with 11,649,000 bbl. (revised) at the beginning of the month.

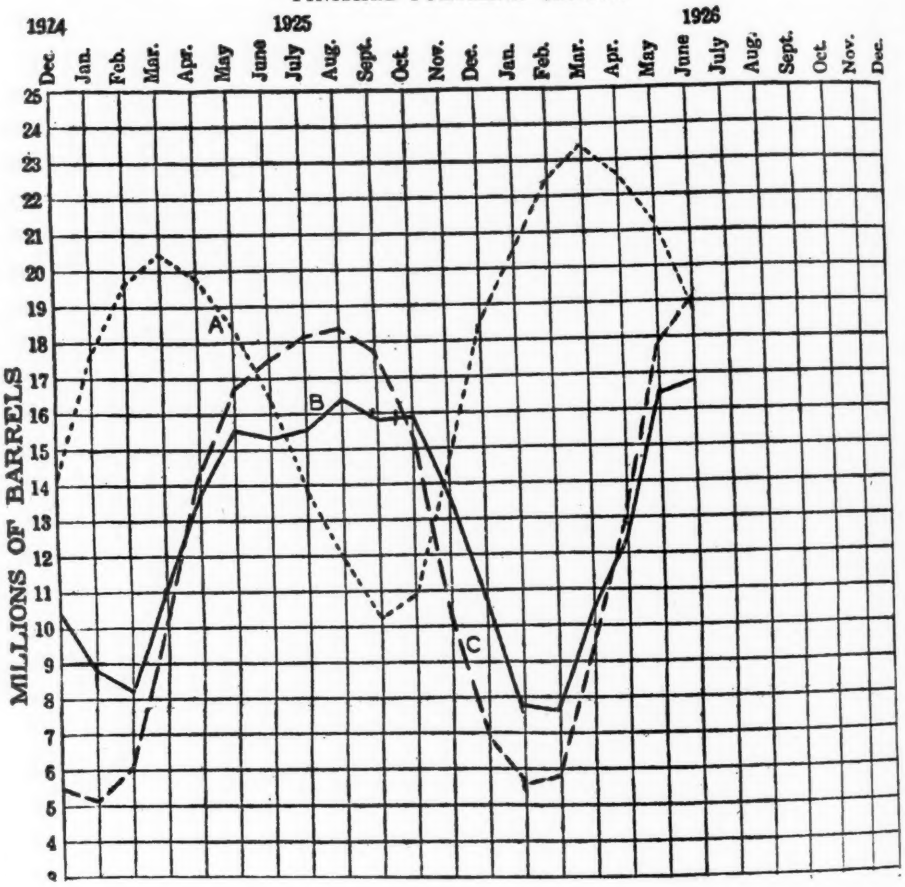
An estimate of the unground clinker by months is given below:

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1925 AND 1926, IN BARRELS

Month	1925	1926
January	7,017,000	9,074,000
February	8,497,000	10,931,000
March	9,962,000	12,284,000
April	9,731,000	12,934,000
May	9,053,000	*11,649,000
June	7,937,000	10,088,000
July	6,961,000	....
August	5,640,000	....
September	4,561,000	....
October	4,086,000	....
November	5,013,000	....
December	6,469,000	....

*Revised.

MONTHLY FLUCTUATIONS IN PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT



(A) Stocks of finished portland cement at factories. (B) Production of finished portland cement. (C) Shipments of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during April and May, 1925 and 1926:

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN APRIL AND MAY, 1925 AND 1926, IN BARRELS*

Shipped to	1925—April	April—1926	1925—May	May—1926
Alabama	191,451	215,372	185,314	184,774
Alaska	709	957	0	2,296
Arizona	31,264	40,257	32,749	37,717
Arkansas	94,695	62,646	87,340	64,713
California	1,027,744	850,124	1,081,945	1,165,540
Colorado	131,363	104,386	125,744	119,761
Connecticut	160,616	149,459	177,292	209,515
Delaware	41,573	48,259	28,892	38,972
District of Columbia	70,765	82,579	103,996	85,961
Florida	261,180	323,909	313,846	386,712
Georgia	112,250	171,829	127,545	186,398
Hawaii	2,250	27,999	5,608	13,705
Idaho	28,393	47,688	28,613	58,044
Illinois	1,467,815	961,090	1,790,601	1,671,317
Indiana	433,996	309,435	569,436	548,639
Iowa	284,477	219,716	346,484	317,323
Kansas	232,220	204,165	242,880	259,208
Kentucky	174,795	141,204	195,351	185,751
Louisiana	108,250	99,889	99,402	96,519
Maine	36,163	33,345	38,435	51,441
Maryland	207,844	199,076	231,935	279,126
Massachusetts	344,406	298,326	374,243	362,878
Michigan	859,815	582,549	1,140,027	1,206,893
Minnesota	321,854	296,040	425,473	496,800
Mississippi	48,174	65,511	47,573	73,146
Missouri	489,316	505,850	652,330	696,773
Montana	23,030	23,063	28,170	23,832
Nebraska	180,951	170,591	198,333	190,275
Nevada	10,767	8,478	11,676	8,165
New Hampshire	39,906	37,909	36,814	46,559
New Jersey	722,751	597,846	721,605	770,730
New Mexico	19,699	71,794	17,141	12,004
New York	1,717,441	1,633,792	2,028,808	2,223,644
North Carolina	277,616	357,978	289,056	424,474
North Dakota	38,937	39,039	47,789	58,351
Ohio	894,683	668,293	1,054,230	1,186,056
Oklahoma	201,886	220,016	235,096	229,209
Oregon	101,661	126,874	129,048	127,318
Pennsylvania	1,250,501	1,242,840	1,482,560	1,613,851
Porto Rico	0	0	0	0
Rhode Island	79,063	64,303	72,914	96,407
South Carolina	65,806	49,573	74,198	58,544
South Dakota	57,039	43,693	66,445	61,899
Tennessee	133,037	178,683	163,812	201,130
Texas	401,517	411,203	373,605	431,773
Utah	33,469	35,218	41,447	31,753
Vermont	25,353	14,358	24,178	28,202
Virginia	160,139	161,284	154,167	196,368
Washington	180,845	189,037	265,735	212,259
West Virginia	134,357	154,113	140,992	217,387
Wisconsin	358,379	277,196	507,654	537,441
Wyoming	19,981	13,887	32,466	17,558
Unspecified	34,875	56,420	8,023	69,750
	14,327,067	12,889,141	16,659,016	17,874,866
Foreign countries	66,933	71,859	75,984	76,134
Total shipped from cement plants	14,394,000	12,961,000	16,735,000	†17,951,000

*Includes estimated distribution of shipments from three plants in May, 1926 and from four plants in April and May, 1925, and in April, 1926.
†Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1925 AND 1926, IN BARRELS

Month	Production 1925	Production 1926	Shipments 1925	Shipments 1926	Stocks at end of month 1925	Stocks at end of month 1926
January	8,856,000	7,887,000	5,162,000	5,672,000	17,656,000	20,582,000
February	8,255,000	7,731,000	6,015,000	5,820,000	19,897,000	22,384,000
March	11,034,000	10,355,000	10,279,000	9,539,000	20,469,000	23,200,000
First quarter	28,145,000	25,973,000	21,456,000	21,031,000	....	....
April	13,807,000	12,401,000	14,394,000	12,961,000	19,882,000	22,640,000
May	15,503,000	*16,472,000	16,735,000	*17,951,000	18,440,000	*21,173,000
June	15,387,000	16,827,000	17,501,000	19,013,000	16,409,000	18,987,000
Second quarter	44,697,000	45,700,000	48,630,000	49,925,000	....	....
July	15,641,000	....	18,131,000	....	13,896,000	....
August	16,419,000	....	18,383,000	....	11,952,000	....
September	15,939,000	....	17,711,000	....	10,247,000	....
Third quarter	47,999,000	....	54,225,000	....	....	....
October	15,992,000	....	15,309,000	....	10,979,000	....
November	13,656,000	....	10,187,000	....	14,534,000	....
December	10,713,000	....	6,917,000	....	18,365,000	....
Fourth quarter	40,361,000	....	32,413,000	....	....	....
	161,202,000	....	156,724,000	....	....	....

*Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN JUNE, 1925 AND 1926, AND STOCKS IN MAY, 1926, IN BARRELS

Commercial district	Production 1925—June	Production June—1926	Shipments 1925—June	Shipments June—1926	Stocks at end of 1925—June	Stocks at end of June—1926	Stocks at end of May, 1926*
E'n Penn., N. J. & Md.	3,554,000	3,956,000	4,340,000	4,629,000	3,321,000	3,957,000	4,629,000
New York	809,000	890,000	986,000	1,081,000	985,000	1,227,000	1,418,000
Ohio, W'n Penn. & W. Va.	1,587,000	1,616,000	1,839,000	2,007,000	1,735,000	2,226,000	2,617,000
Michigan	1,140,000	1,430,000	1,320,000	1,614,000	1,065,000	1,731,000	1,915,000
Wis., Ill., Ind. & Ky.	2,441,000	2,407,000	2,553,000	2,896,000	3,106,000	2,964,000	3,454,000
Va., Tenn., Ala. & Ga.	1,176,000	1,468,000	1,369,000	1,411,000	410,000	1,125,000	1,068,000
E'n Mo., Ia., Minn. & S. Dak.	1,461,000	1,545,000	1,720,000	1,846,000	2,808,000	2,517,000	2,819,000
W'n Mo., Neb., Kan. & Okla.	1,147,000	1,129,000	1,095,000	1,105,000	1,615,000	1,454,000	1,430,000
Texas	389,000	416,000	444,000	454,000	241,000	478,000	515,000
California	1,073,000	1,281,000	1,123,000	1,305,000	451,000	502,000	526,000
Colo. & Utah	216,000		221,000		343,000		
Colo. & Utah; Ore, Wash. & Mont. (combined)		689,000		665,000		806,000	782,000
Ore, Wash. & Mont.	394,000		491,000		329,000		
	15,387,000	16,827,000	17,501,000	19,013,000	16,409,000	18,987,000	21,173,000

*Revised.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN MAY, 1926

Imported from	District into which imported	Barrels	Value
Belgium	Maine & N. H.	6,726	$9,937
	Massachusetts	46,635	68,396
	New York	3,014	6,288
	Florida	5,052	10,250
	Mobile	11,659	17,769
	New Orleans	25,230	40,673
	San Francisco	161	218
	Oregon	3,294	7,915
	Total	101,771	$161,446
Canada	Maine & N. H.	30	$125
	St. Lawrence	560	1,075
	Total	590	$1,200
Denmark and Faroe Islands	Florida	30,383	$49,721
	Porto Rico	8,454	15,652
	Total	38,837	$65,373
France	Massachusetts	25,444	$25,037
	New York	465	620
	New Orleans	2,091	4,421
	Total	28,000	$30,078
Germany	Los Angeles	203	508
	Washington	589	1,408
	Total	792	$1,916
Japan	Hawaii	1,555	$2,326
Netherlands	New Orleans	4,992	$7,489
United K'gdom	Florida	33,177	$46,139
	Los Angeles	1,531	4,611
	Porto Rico	11,885	16,453
	Total	46,593	$67,203
	Grand total	223,130	$337,031

EXPORTS AND IMPORTS*

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN MAY, 1926

Exported to	Barrels	Value
Canada	1,640	$7,788
Central America	7,823	20,959
Cuba	12,585	29,192
Other West Indies	8,824	19,056
Mexico	12,815	36,648
South America	32,232	96,505
Other countries	2,682	14,217
	78,601	$224,365

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO IN MAY, 1926*

	Barrels	Value
Alaska	3,255	$10,839
Hawaii	14,536	36,058
Porto Rico	3,500	7,964
	21,291	$54,861

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

†Imports and exports in June, 1926, not available.

IMPORTS AND EXPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1925 AND 1926

Month	Imports 1925 Barrels	Imports 1925 Value	Imports 1926 Barrels	Imports 1926 Value	Exports 1925 Barrels	Exports 1925 Value	Exports 1926 Barrels	Exports 1926 Value
January	231,258	$364,196	360,580	$576,717	71,596	$207,547	72,939	$216,431
February	119,077	206,308	314,118	527,948	56,249	181,356	73,975	220,706
March	218,048	337,039	493,241	812,968	65,248	200,410	69,080	205,647
April	197,686	280,826	257,302	398,114	89,508	263,831	96,296	284,772
May	186,897	286,959	223,130	337,031	85,385	250,845	78,601	224,365
June	254,937	409,539	(†)	(†)	71,343	217,899	(†)	(†)
July	335,118	499,602	....	....	98,141	286,543	....	....
August	379,847	611,551	....	....	103,961	289,904	....	....
September	513,252	789,121	....	....	102,649	285,225	....	....
October	535,050	824,268	....	....	73,369	228,467	....	....
November	388,604	678,518	....	....	101,825	294,201	....	....
December	295,543	526,001	....	....	100,323	296,900	....	....
	3,655,317	$5,813,928	....	....	1,019,597	$3,003,128	....	....

Lehigh Portland Purchases Quarter Interest in Great Lakes Portland

PRESIDENT ADAM L. BECK of the Great Lakes Portland Cement Co. announced recently that the company had increased its capitalization from $3,000,000 to $4,000,000 and that the additional million-dollar interest was taken by the Lehigh Portland Cement Co., Easton, Penn. The Lehigh company is not, however, taking control, Mr. Beck said, and there will be no changes in the plant which the Great Lakes company is erecting on the Hamburg turnpike.

The new plant, it is expected, will be in production in April of next year with a daily capacity of about 7,000 bbl.—*Buffalo (N. Y.) News.*

Florida Lime Rock Corporation Granted Charter

THE Florida Lime Rock Corp. with an authorized capital of $500,000 has just been granted a charter by the state department at Tallahassee, Fla.

The lime rock deposits of the company is near the surface, the report states.

The engineer's report is said to show that there are more than 5,000,000 tons in a portion of the deposit of the company's property located in Alachua county, with other parts of the property not yet fully surveyed, and it is estimated that these will bring the total to about 15,000,000 to 20,000,000 tons. The analysis is said to show 98% limestone and of a quality and condition to mine very easily. Practically all of the lime is near the surface, the report states. The complete plans of the company call for equipment to turn out 2000 to 3000 tons of stone per day, for which machinery will be installed as soon as possible on the property.

F. E. Richardson is president of the company, S. M. Ybor, vice-president, and W. A. Freeman, secretary and treasurer. The company contemplates the manufacture of a part of their output into byproducts such as agricultural lime, burned lime, builders lime, pressed brick and fertilizer. General offices will be opened at Gainesville immediately. The services of Rufus S. Freeman, advertising agency of Tampa, have been retained to handle the advertising campaign for the byproducts of the company and to prepare their literature.—*Gainesville (Fla.) Sun.*

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

CENTRAL FREIGHT ASSOCIATION DOCKET

13629. **Crushed stone**, carloads, Spore, O., to Cleveland and Akron, O., via the B. & O. R. R. Present rates, 6th class; proposed, 90c per net ton.

13630. **Gravel and sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica), carloads, Urbana, O., to Milford Center and Unionville, O. Present rate, 70c per net ton; proposed, 60c and 65c per net ton, respectively.

13635. **Sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica), and gravel, carloads, Pleasant Lake, Ind., to Dunfee, Ind. Present rate, 88c per net ton; proposed, 85c per net ton.

13641. **Crushed stone**, in bulk, in open top cars, carloads, Piqua, O., to Meeker, O. Present rate, 70c per net ton; proposed, 60c per net ton.

13642. **Sand**, blast, core, engine, filter, fire or furnace, foundry, glass, grinding, polishing, loam, moulding or silica, carloads. Rockmere and Siverly, Pa., to Grove City, Pa. Present rate, no through class or commodity rates in effect; proposed, 126c per ton of 2000 lb.

13644. **Sand**, blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica, carloads, Siverly, Pa., to Meadville, Pa. Present rate, 135c per ton of 2000 lb.; proposed, 126c per ton of 2000 lb.

13645. **Moulding sand**, carloads, Riverside, Mich., to Muskegon, Mich. Present rate, 151c per net ton; proposed, 139c per net ton.

13654. **Crushed stone**, carloads, East Liberty, O., to Thurston and Williamstown, O. Present rate, 6th class; proposed, 80c per net ton.

13659. **Sand**, viz.: Blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing loam, moulding and silica, carloads, to Pittsburgh, Pa., from various points.

Rates in cents per net ton.

From—	Pres.	Prop.
Rush Run and Brilliant	113	126
Eastbrook, East New Castle, Leesburg, New Castle, Schollard and West Middlesex	126	139
Atlantic, Pa.; Burnetts, O.; Greenville, Pa.; Hartford, O.; Heinlein, Pa.; Mahoning, Pa.; Ohlton, O.; Osgood, O., and Phalanx, O.	139	151
Geauga Lake, O.	151	164

13662. **Sand**, carloads, Port Washington, O., to Somerset, O. Present rate, 15c; proposed, 120c per ton of 2000 lb.

13663. To establish minimum weight of 30,000 lb. on common, hydrated, quick or slacked lime, carloads, between Michigan, also from Michigan to C. F. A. territory. Present minimum weight, 36,000 lb.

13665. **Sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica) and gravel, carloads, Fort Wayne, Ind., to Sturgis, Mich. Present rate, 6th class; proposed, 80c per net ton.

13666. **Crushed stone**, carloads, Woodville, Gibsonburg and Maple Grove, O., to Curtice and Williston, O. Present rate, 6th class; proposed, 80c per net ton.

13678. **Crushed stone**, carloads, Bascom, O., to Toledo, O. Present rate, 70c per net ton; proposed, 60c per net ton.

13690. **Crushed stone**, carloads, East Liberty, O., to Enon, O. Present rate, 6th class; proposed, 80c per net ton.

13676. **Crushed stone**, carloads, East Liberty, O., to Edison, O. Present rate, 6th class; proposed, 85c per net ton.

SOUTHERN FREIGHT ASSOCIATION DOCKET

27938. **Stone**, from Rockton, S. C. (when from Rion, S. C.), Holton, Ga., and Stockbridge, Ga., to West Palm Beach, Fla. It is proposed to establish rates on stone, crushed, rubble or jetty; carloads, minimum weight 90% of marked capacity of car except when cars are loaded to their visible capacity, actual weight will govern to West Palm Beach, Fla., from Rockton, S. C. (when from Rion, S. C.), 300c; Holton, Ga., 300c, and Stockbridge, Ga., 311c per ton 2000 lb., made on basis of using proportional rate reduced under Agent Jones' combination tariff to Jacksonville, Fla., plus the proportions acceptable to the F. E. C. Ry. beyond.

27978. **Limestone or marble**, from Knoxville, Mascot, Strawberry Plains, Tenn., Buquo and Hot Springs, N. C., to East Point, Ga. It is proposed to cancel present rates to East Point, Ga., from Knoxville, Mascot and Strawberry Plains, Tenn., $3.05; Buquo and Hot Springs, N. C., $2.84 per net ton, permitting the Atlanta rate, plus switching charge, to apply.

27980. **Sand**, from Ohio River crossings to Lenoir City and Athens, Tenn. At present rate of 315c per ton of 2000 lb. applies. It is proposed to establish rate of 248c per ton of 2000 lb. on sand, moulding, carload minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Ohio River crossings to Lenoir City and Athens, Tenn., made the same as in effect to Cleveland, Tenn.

27991. **Stone**, broken or crushed, from Frankfort, Ky., to Junction City and Winchester, Ky. Lowest combination rates now apply. Proposed rates on stone, broken or crushed, carload, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Frankfort, Ky.: To Junction City, 130c; Winchester, 100c per net ton; same as rates from and to other points on the L. & N. R. R. for similar distances.

28008. **Phosphate rock**, from Mt. Pleasant, Centreville district to Cairo, Ill. Present rate, 349c per ton; proposed rate on phosphate rock, crude lump or phosphate rock, crude ground, in bulk or in bags, carload, subject to minimum now applicable in connection with present rate, 315c per ton, same as rate in effect to Evansville, Ind.

28023. **Ground flint** and/or **glass sand** from Mendota and Silica, Va., to points in Central Freight and Illinois Freight Association territories. In lieu of combination rates now applicable, it is proposed to establish rates on ground flint and/or glass sand, carloads, minimum weight 90% of marked capacity of car, except where car is loaded to cubical or visible capacity, actual weight will apply, from Mendota and Silica, Va., to points in C. F. A. and I. F. A. territories predicated on the basis of using rate of 237c per net ton to Cincinnati, plus proportions acceptable to lines beyond. Statement of rates proposed to destinations involved will be furnished upon request.

28047. **Stone**, crushed or rubble, from Woodleaf, N. C., to Charlotte, N. C. Present rate, 83c; proposed rate on stone (crushed or rubble), carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to visible capacity, actual weight will govern, from Woodleaf to Charlotte, N. C., 79c per net ton, made no higher than the present rate on gravel, carloads, from Lilesville, Pee Dee, West End and Eagle Springs to Charlotte, N. C.

28077. **Granite or stone**, from Georgia R. R. shipping points to Erie, Pa. The present rate on granite or stone, viz.: Paving, curbing, flagging, foundation or building stone, cut to dimensions, but not sawed, sand rubbed, slushed, polished or carved; rough unfinished quarry blocks, carloads, minimum weight 40,000 lbs., is 587c per net ton; proposed rate, 539c per net ton, which compares favorably with rates to Erie, Pa., from Carolina quarries. The origin points are Conyers, Lithonia, Redan and Stone Mountain.

28098. **Stone, crushed or broken**, from Pine Hill, Ky., to Kentucky points. It is proposed to establish reduced rate of 77c per 100 lb. on stone, crushed or broken, carloads, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, from Pine Hill, Ky., to Shelby City, Knob Lick, Stanford, Rowland, Maywood, Crab Orchard and Gum Sulphur, Ky., same as rate in effect from Sparks Quarry.

28118. **Sand and gravel**, from Nashville, Tenn., to Madison and Edenwold, Tenn. It is proposed to establish reduced intrastate rate of 60c per net ton on sand and gravel, straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, from and to points mentioned above. The proposed rate is for the purpose of meeting truck competition.

28151. **Sand and gravel**, from City Point, Va., to Carolina points. The present rates on sand (except glass and moulding sand) and gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from City Point, Va., to points in Carolina territory located on Norfolk So. R. R. and So. Ry., are 50c per ton higher than the rates from Petersburg, Va. It is proposed to revise the rates on sand and gravel, as described, from and to the points named above, to be the same as now in effect from Puddledock and Petersburg, Va.

28172. **Stone, broken or crushed**, from Russellville, Ky., to Kentucky points. It is proposed to establish reduced rates of 95c per net ton on stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their capacity, actual weight will apply, from Russellville, Ky., to Madisonville, Ky. (15c per ton higher than from Cerulean, Ky.), observing same at intermediate points on the L. & N. R. R., Henderson Division, viz.: Earlington, Barnsley, Morton, Nortonville, Mannington, Empire, Grafton and Kelly, Ky. The present rate to Madisonville is 117c per net ton.

SOUTHWESTERN FREIGHT BUREAU DOCKET

8991. **Lime**, from points in Missouri and Arkansas to points in Oklahoma. To establish the following rates in cents per 100 lb. on lime, carloads, minimum weight 30,000 lb., from kilns in Missouri and Arkansas in Groups 1 and 2 as per St. L.-S. F. Tariff 69K to points shown below:

——From——
To—A. T. & S. F. Ry.— Group 1 Group 2
Index (Oklahoma) Rates Rates

To—A. T. & S. F. Ry.— Index (Oklahoma)	From— Group 1 Rates	Group 2 Rates
4336—South Shawnee	26	26
4338—Trackery	26	26
4340—Tecumseh	26	26
4342—Macomb	26	26
4344—Tribbey	26	26
4346—Trousdale	26	26
4348—Wanette	26	26
4350—Byars	26	26
4356—Schlegel	26	26
4358—Pemeta	26	26
4360—Frey	26	26
4362—Oilton	26	26
4364—Player	26	26
4366—Ruska	26	26
4412—Flynn	27½	27½
4414—Moore	27½	27½
4416—Norman	27½	27½
4418—Noble	27½	27½
4420—Walker	27½	27½
4422—Purcell	27½	27½
4494—Lehigh	27½	27½
4496—Nixon	27½	27½
4498—Tupelo	26	26
4500—Stonewall	26	26
4502—Frisco	26	26
4504—Center	26	26
4506—Vanoss	26	26
4508—Stratford	26	26
4510—Rosedale	26	26
To G. C. & S. F. Ry. (Oklahoma)—		
15670—Wayne	27½	27½
15672—Paoli	27½	27½
15674—Gulf Junction	27½	27½
15676—Wynnewood	27½	29
15678—Kickapoo Sand Spur	27½	29
15680—Davis	27½	29
15682—Dougherty	27½	29
15684—Marston Spur	27½	29
15686—Crusher Spur	27½	29
15688—Berwyn	27½	29

The above changes are desired in order to eliminate Fourth Section departures and the rates published from Ash Grove, Mo., and Johnsons, Ark. Groups are merely to restore the old differentials.

9003. **Crushed stone**, from Hollister, Kan., to stations in Missouri. To establish the following mileage scale on crushed stone, carloads, minimum weight 90% of marked capacity of car, except that when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will apply. In no case shall the minimum weight be less than 40,000 lb., from Hollister, Kan., to stations on the K. C. S., Mo. Pac., St. L.-S. F., and C. R. I. & P.: 50 miles and under, 5c per 100 lb.; 75 miles and over 50, 6½c per 100 lb.; 100 miles and over 75, 7½c per 100 lb.; 150 miles and over 100, 9c per 100 lb. A rock quarry is being developed at Hollister, Kan., and the statement is made that the present basis is prohibitive when taking into

consideration the competition which will be met at such points as Carthage, Webb City and Phenix, the proposed basis appears entirely reasonable.

9081. **Sand,** from Guion, Ark., to Blackwell, Okla. To establish rate of 13½c per 100 lb. on sand, carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity of car will govern, from Guion, Ark., to Blackwell, Okla.

Distance considered, the proponent feels that he is entitled to the same rate as in effect from Pacific, Mo.

9087. **Crushed slate, quartz, etc.,** from points in Arkansas to Lower Mississippi River crossings. To establish rate of $4.62 per ton of 2240 lb. on crushed slate, crushed quartz and crushed silica in straight or mixed carloads, minimum weight 40,000 lb., from Caddo Gap, Glenwood and Norman, Ark., to Nachez, Vicksburg, Miss., and New Orleans, La.

In view of the fact that it is now contemplated to resume operation of the state quarries, request has been received to re-establish the rates from Caddo Gap and Glenwood and also make the rates apply from Norman, which point is located five miles west of Caddo Gap and at the end of the Womble Branch of the Missouri Pacific.

9104. **Sand,** from Guion, Ark., to Chattanooga, Tenn. To establish rate of $3.51 per ton of 2000 lb. on sand, carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity will govern, from Guion, Ark., to Chattanooga, Tenn.

It is stated that the publication of the above is for application via all lines.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

10421. **Moulding sand,** minimum weight 90% marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Elnora, N. Y., Mechanicville, Reynolds, Schaghticoke, Schuylerville, Scotia, Saratoga Springs, Stillwater, Wayville and Ushers, N. Y., to Oswego, N. Y., 11c, via Rotterdam Jct., N. Y., and N. Y. C. R. R. Reason—To place B. & M. sand shipping stations on a parity with those located on the N. Y. C. R. R.

10517. **Talc,** crude, in bags or bulk, from Johnson, Vt., to Nashville, Tenn., 50c; to Chattanooga, Tenn. (and points taking same rates), 51½c, via all routes authorized in F. L. Speiden's I. C. C. 884. Reason—To equalize rates in effect from competing territory.

10522. **Stone,** broken or crushed, and commodities taking same rates, per N. Y. N. H. & H. R. R. I. C. C. F2795, in bulk or gondola or other open cars, straight or mixed carloads, minimum weight 90% marked capacity of car, except when cars are loaded to cubical or visible capacity, actual weight will apply, from Connecticut Quarries, viz.: Pine Orchard (Branford), Beckley's (East Berlin), East Haven, Reed's Gap (East Wallingford), Meriden, York Hill (Meriden), Cook's (New Britain), and Rocky Hill, Conn., to Bridgeport, Fairfield and Westport and Saugatuck, Conn., 85c per ton of 2000 lb. Reason—Necessary to avoid establishment of reduced rates—for which no commercial necessity exists—between other stations.

10523. **Stone,** broken or crushed, and commodities taking same rates, per N. Y. N. H. & H. R. R. I. C.C. F2795, in bulk or gondola or other open cars, straight or mixed carloads, minimum weight 90% marked capacity of car, except when cars are loaded to cubical or visible capacity, actual weight will apply, from Bradford, R. I., to following New London, Norwich, Conn., Wickford N. Y. N. H. & H. R. R. stations: Groton, Ldg., Hills Grove, Providence, Pontiac, Hope, South Providence, Stillwater, Harrisville, Wallum Lake, Fox Point, Barrington, Bristol, Darlington, Albion, Woonsocket, Abbott's Run, Grant's Mills, Rumford, Portsmouth, Newport, Coventry, Green, R. I., and Fall River, Mass., 85c per ton of 2000 lb. Reason—Equalization of competitive conditions.

10544. **Stone,** crushed (trap rock), minimum weight 90% of marked capacity of car, but in no case less than 54,000 lb., from Westfield, Mass., to Pittsfield, Mass. (N. Y. N. H. & H. R. R. delivery), $1.25 per ton of 2000 lb., including N. Y. N. H. & H. R. R. switching charges at Pittsfield, Mass., not to exceed 38c per ton, via B. & A. R. R. Reason—To equalize rate of competing carrier.

10561. **Lime,** minimum weight 50,000 lb., from Highgate Springs, Fonda Jct., Winooski, Vt., to Philadelphia, Pa., and Germantown, Pa., 25. Reason—To place shippers on a parity with rates to other consuming points in T. L. territory, also from T. L. territory to New England.

10572. **Sand,** core, minimum weight, marked capacity of car, from Davisville, R. I., to Chicopee Falls, Mass., 14. Reason—To permit new movement of traffic.

10573. **Sand,** core, minimum weight, marked capacity of car, from Davisville, R. I., to Biddeford, Me., 13. Reason—To permit movement of traffic.

Sand, Gravel and Stone Men Fight Drastic Restrictions on Overloading

V. P. AHEARN, executive secretary of the National Sand and Gravel Association, informs us that the association has lodged a formal protest with Chairman Leland of the Southwestern Freight Bureau, and has enlisted the aid of the American Railway Association, to bring about the elimination of some drastic new restrictions upon overloading sand and gravel. In these protests the National Sand and Gravel Association has been joined by the National Crushed Stone Association, and local organizations of producers in the territory affected. Mr. Ahearn states that it is his understanding that the proponents of these drastic restrictions on overloading have merely picked on the Southwest territory to try them out, and if successful there will attempt to make them of general application. Therefore the matter is of far more than local interest. The proposed restrictions read as follows:

Southwestern Freight Bureau Docket

Docket Bulletin 355 to be considered at Bureau Headquarters in St. Louis not earlier than June 11th. F. A. Leland, Chairman, Century Bldg., St. Louis.

Item 8530: (2) RULES GOVERNING OVERLOADED CARS FROM, TO AND BETWEEN SOUTHWESTERN FREIGHT BUREAU TERRITORY: Correct the present varying rules governing the handling of overloaded cars and the charges to be assessed for transfer thereon to provide a uniform rule applicable on all commodities except grain between points in S. W. F. Bureau Territory as follows:

(a) When cars are weighed at point of origin and found to be loaded in excess of the maximum weights provided in (X) shipper will be required to unload a sufficient quantity to reduce the minimum weight to the authorized maximum. No charge for switching will be made.

(b) In case a car is found, after leaving point of origin and before arrival at destination to be loaded in excess of the maximum weight provided in (X) its contents will be transferred into a car of suitable capacity except that, if such car is not available at the weighing station, two cars will be used, the weight of the entire shipment to be divided as nearly equal as possible, the two cars to be billed at the actual weight, subject to the prescribed minimum weight for each car.

(c) A charge of two (2) cents per 100 pounds, plus switching charges, as per tariffs lawfully on file with the Interstate Commerce Commission or with State Commissions, to and from the transfer track, will in all cases (except as per paragraph "a") be made to cover the cost of transfer and extra switching incident thereto. Such charges to be added in red ink in the freight column of the waybill as "charges for transferring overloaded car."

(d) In case a car is handled to destination and found to be loaded in excess of the maximum weight provided in (X) charges on the shipment will be assessed at the established carload rate for weight equal to the maximum weight provided in (X) plus a charge at double the established carload weight (that word probably should be "rate") on the weight in excess of the maximum provided in (X).

X (Each carrier to show reference to their issue providing maximum load limits.)

The lack of uniformity in the rules of the various Southwestern carriers causes constant agitation and dissatisfaction, and it is felt that the adoption of a uniform rule as suggested will not only be satisfactory to shippers but will prove quite advantageous to the carriers in eliminating claims and controversial correspondence.

Item 8499: (2) SWITCHING CHARGES AT POINTS IN SOUTHWESTERN FREIGHT BUREAU TERRITORY: Provide in switching tariffs of various lines, a switching charge to cover the movement of cars discovered to be overloaded at track scale stations from such track scale to the transfer track and back to the train yard, as follows: "Charge of (individual carriers to insert figures equal to double the regular one way switching charge applicable at station involved) will be assessed for switching cars which are found to be overloaded, from the track scale to the transfer track and back to the train yard."

In the interest of uniformity, it is desired to provide in connection with all lines tariffs a charge equivalent to double the switching charge assessed at the station involved, to cover the double switching service necessary to cut the car out when it is found to be overloaded, and place it on the transfer track for readjustment of the load to eliminate the overload, and the return of the car to the train yard for outbound movement, which involves two separate switching services.

Western Carriers Denied Increase

THE application of western railroads for a 5% increase in freight rates (ex parte 87 and docket No. 17000) was denied in a lengthy opinion handed down by the Interstate Commerce Commission, and in the same opinion the application of farm organizations for lower freight rates on agricultural products was also denied. (For complete details consult ROCK PRODUCTS, January 23 and June 12 issues.)

The commission supported the view that depression has existed and exists at present, but held that the effects of the depression had not been reflected in the earnings of the roads to an extent to justify an increase in rates, and also that if the reduction asked for by the farming interests were granted, the solvency of the roads would be threatened unless other commodities could be found to be carried at a higher rate.

Conclusions reached by the commission in its decision are:

1. No such financial emergency exists in the western district as to demand an increase in rates.

2. The earnings of carriers as a whole in the western district have not been such as to warrant any general revision of rates downward on products of agriculture or industries subject to depression. However, the decision with respect to the farmers application for reduction disclosed that further investigations would be conducted under the authority of the Hoch-Smith resolution passed by Congress in January of last year, directing the commission to make a thorough study of the freight rate structure with a view to determining what rates, if any, are unjust, unreasonable, discriminatory or unduly preferential.

The commission also rejected the plea of the carriers for the creation of a new southwestern group and a new mountain-Pacific-southern group for purposes of rate adjustment, on the ground that it would not make any easier the determination of just rates.

Sand-Lime Brick Industry's Production in June

THE tabulation below contains the reports of 13 sand-lime brick operators for the month ending June 30. One of the plants (in Florida) reporting did not operate at all during the month, being shut down for repairs. This number is about one-third of the total number of sand-lime brick plants in the United States and Canada, but those reporting include all of the larger operations and the figures given we believe constitute at least half of the total production of the two countries. This estimate was recently verified by an expert of the Sand-Lime Brick Association.

Sand-Lime Brick Statistics for the Month of June

Production, June, 1926	17,192,125
Shipments by rail	8,983,550
Shipments by truck	8,035,985
Stocks on hand	5,468,725
Unfilled orders	22,546,000

The production for June is 1,000,000 brick larger than production for May, reported in our June 26 issue, with one less plant reporting. Stocks on hand are 2,000,000 less than May, and unfilled orders 2,000,000 more.

Average Price of Sand-Lime Brick for Month of June

The following are average prices of sand-lime brick for June:

	Plant Price	Delivered
Milwaukee, Wis.	$10.50	$13.00
Detroit, Mich.	14.85†	17.50†
Detroit, Mich.	12.00	15.10
Toronto, Ont.	13.10	15.60
Minneapolis, Minn.	10.00	12.75*
Woburn, Mass.	13.98	16.73
Jackson, Mich.	12.25	....
Dayton, Ohio	12.50	15.50
Hartford, Conn.	14.00	....
Grand Rapids, Mich.	....	12.75
Michigan City, Mich.	10.50	....

†Retail price.
*$16.50 in less than carload lots.

The U. S. Department of Commerce recently announced that, according to data collected at the biennial census of manufacturers, 1925, establishments engaged in the manufacture of sand-lime brick reported the production of 308,703,000 of brick valued at $3,716,654, as compared with 283,417,000 valued at $3,334,503 in 1924, and 213,425,000 valued at $2,471,536 in 1923, representing an increase of 8.9% in quantity and 11.5% in value over 1924 and 44.6% in quantity and 50.4% in value over 1923.

The industry in general seems to be in excellent condition, as evidenced by the large excess of unfilled orders over stocks on hand, and over the production figures for June. Milwaukee, Wis., territory, however, reports a yard filled with stock on hand with new building work very slow, without any indications of improvement. Building there is about 15% behind last year at this time and producers were prepared for about a 25% increase in capacity. Prices remain about the same as last year.

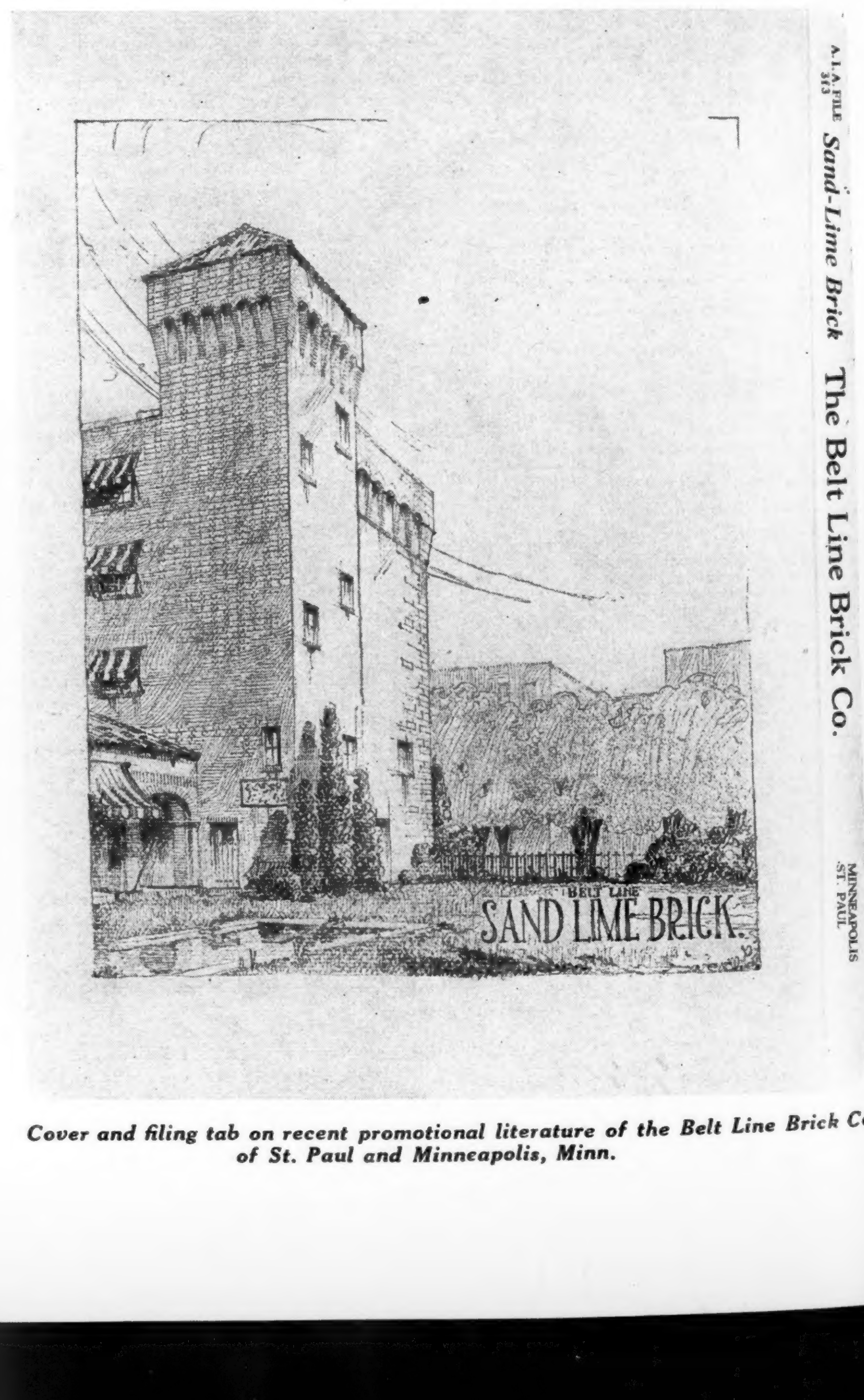
In the Twin Cities of St. Paul and Minneapolis, Minn., the Belt Line Brick Co. reports 75% of all building operations are using sand-lime brick. This company has just issued a very attractive promotional booklet of 10 pp., 9⅜x11¾ in., bound especially to fit in the standard file prescribed by the American Institute of Architects. The cover design is an excellent reproduction of a pencil sketch on heavy brown drafting paper, and the make-up and typography are in keeping with the cover.

The message of the booklet is the architectural attractiveness of sand-lime brick. This is supplemented by a description of the plant and process, based on a description of the Belt Line Brick Co.'s plant in the December, 1925, issue of ROCK PRODUCTS. Specifications for sand-lime brick are included and a reproduction of a report by the Minneapolis city testing laboratory, which shows the brick to have a crushing strength ranging from 80,000 to 109,000 lb., and a moisture absorption of 11.5% to 14.3%. The compression strength figures out from 2590 lb. to 3540 lb. per sq. in. The last page of the booklet gives a list, with a group of views, of some of the principal buildings and their architects who have used this company's sand-lime brick.

Building New Wharf at Buffalo Plant

THE Kelley Island Lime & Transport Co. has recently completed a new wharf at its lime plant at Buffalo, N. Y. This wharf or quay is close to the kilns and is used as storage for the stone as it is unloaded from boats on the Buffalo River.

A former structure failed under a load of stone in 1924. The present wharf is of renforced concrete on long timber piles, the latter being spaced 4 ft. on centers at the points of greatest loading, and 5 ft. for the other parts. The structure is 360 ft. long and 120 ft. in width.



Cover and filing tab on recent promotional literature of the Belt Line Brick Co. of St. Paul and Minneapolis, Minn.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Precast Street Curbing Manufactured Successfully in Buffalo, N. Y.

This Is Guaranteed to the City, Just as Though It Were Cast in Place

PRECAST concrete curbing, made to be set in exactly the same manner as natural stone curbing, is now being successfully manufactured and sold by the Buffalo Wash Tray Co., Buffalo, N. Y., at its River Road (Tonawanda) plant.

In that locality as in some other places about the country, cast-in-place curb has not proven uniformly satisfactory owing to variation in quality and the apparent policy of some paving contractors to make their curb of carelessly proportioned concrete, depending on a mortar surface to withstand the usual rough treatment—frequent violent impact and severe abrasion.

The Buffalo Wash Tray Co. stepped into the situation by offering a precast curb of uniform strength throughout, without variation of quality between various pieces, guaranteed and easily placed and replaced. Precast curbing may now be purchased by the contractor at a price per foot which makes it possible for him to lay it at about the same margin of profit as for the cast-in-place curb, without any wastage or overrun and with ready-made material with a guarantee on it which he merely passes along to the city.

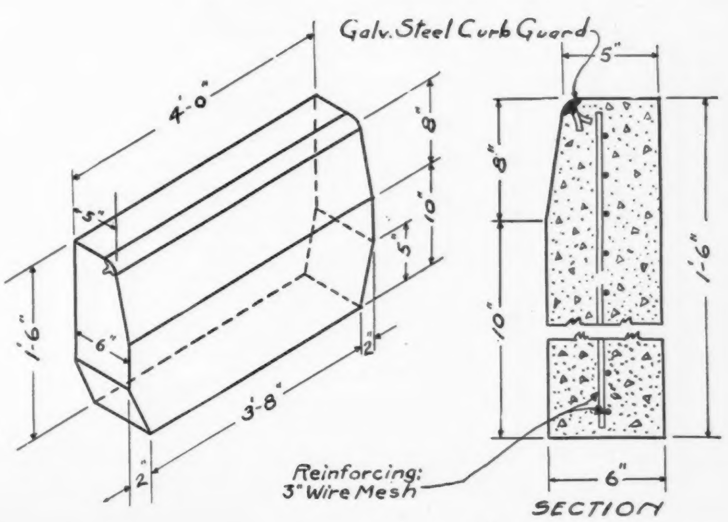


Fig. 1

Fig. 2—Completed stock of precast curbing

Process Under Constant Supervision

The precast curb is made according to predetermined standards, in a factory where accurate proportioning, thorough mixing and careful curing prevail and all steps in the process can be carried on constantly with precision. There is no variation, due to changing weather conditions or aggregates. The problem of city inspection is easy, one inspector having no difficulty in following every step in the manufacturing process constantly. Adequate inspection seems a more difficult matter with field-made concrete.

The standard design precast curb as manufactured extensively by the Buffalo Wash Tray Co. for Tonawanda, Lackawanna and other western New York cities, is made in sections from 1 ft. 7 in. to 4 ft. in length and 1 ft. 6 in. in height, with a width of 6 in. at the base and 5 in. at the top, there being a batter of 1 in. in the upper 8 in., which constitutes the exposed portion of the curb. Fig. 1 shows the details of this design, 3-in. square-mesh reinforcing material, electrically

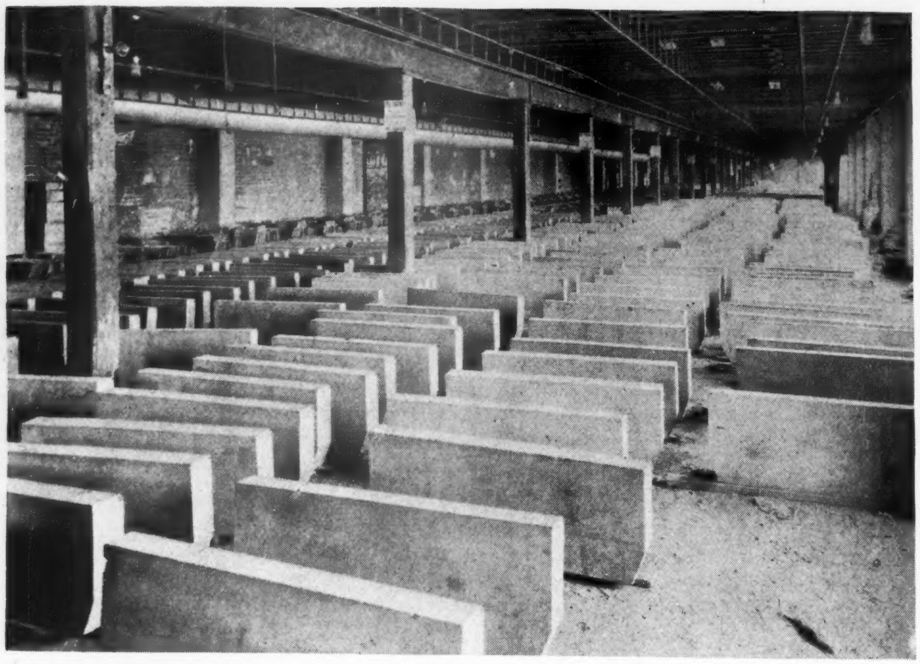


Fig. 3—One of the curing rooms at plant of Buffalo Wash Tray Co., Tonawanda, N. Y.

welded, being placed down the center. Standard galvanized steel nosing has been used in this type, although latest thought seems to favor abandoning this steel corner as practically if not entirely unnecessary, although used at considerable expense.

Good Service Record

A large quantity of precast curbing of the type shown in Fig. 1 has been in use in the cities mentioned above for two years or more, under a variety of conditions. Recent inspection has shown this material to be in excellent condition.

A slightly lighter design, with parallel sides (no batter) is shown in Fig. 4. This type has been used to some extent in Buffalo but is not usually considered as good as the preceding type.

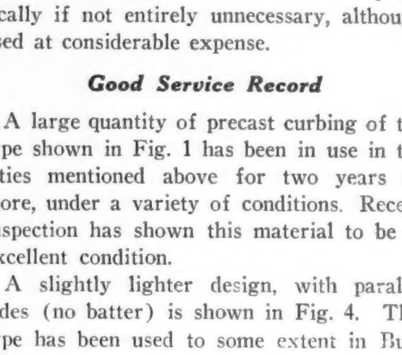


Fig. 4

Fig. 5 shows an entirely new design not yet in use but proposed as possibly having advantages over both of those previously shown. Lengths and heights remain the same, as does width at the base. However, there is a batter of 2 in. in the upper 8 in. which constitutes the exposed portion. The steel nosing is abandoned as obviously unnecessary and the curvature on the top edge is to a long radius, eliminating anything like a breakable corner. Possibilities of abrasion and impact damage are extremely slight. For locations where heavy vehicles would back up to the curb frequently, special heavy steel nosing could be provided without difficulty. Removal of lower end corners prevents binding of the sections below the exposed portion and where necessary makes removal an easy matter, without breakage.

Methods of Manufacture

For precast curbing made by the Buffalo Wash Tray Co. a 1:2:3 mixture of torpedo sand and gravel (a small proportion of which runs from ¾-in. to 1-in. in size) is used. The consistency used is just sufficiently wet to flow in the molds and produce good surfaces with spading. The 1:2:3 mixture at this consistency is expected to give at least 3000-lb. concrete, which is considered adequate for the duty to be performed.

The sections are cast top down in wooden molds. After removal from the molds the curbing is cured in a moist atmosphere at moderate temperature for 30 days before removal to the job.

Figs. 2 and 3 show stock of finished curbing in the factory at Tonawanda, some 60,000 lin. ft. of curb appearing in the pictures. The material is smooth and free from scars, fins, water holes or other blemishes. It is uniform in color and general appearance and very true to dimension, without deformation of any kind. The standard curb shown in Fig. 1 weighs 100 lb, per lin. ft., making all sections easy to handle and quick

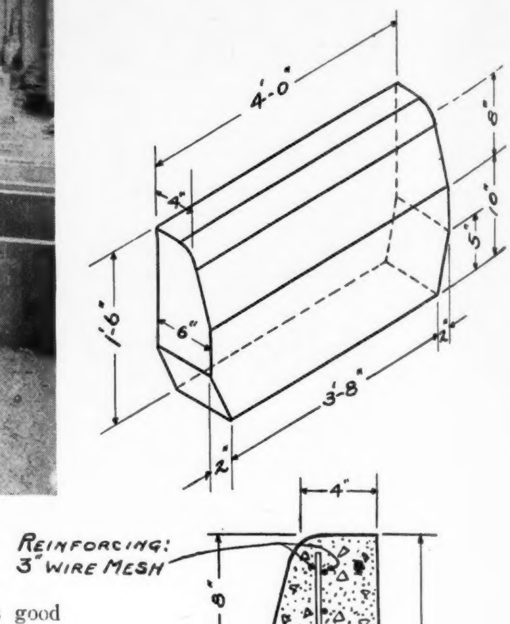


Fig. 5

to lay. Circumferential sections for installation at corners or for special layouts are made to special design in the factory, insuring exact match and fit.

A number of local city engineers and local paving contractors have already expressed themselves favorably regarding the merits of well-made precast curb and inquiry among property owners where this curb is in use show that it is generally regarded as the last word in curb construction by many people who observe it in everyday use.

Favorable Action in Milwaukee

THE Wisconsin Concrete Products Association has just succeeded in getting an agreement from the building officials of Milwaukee to allow the use of 8-in. concrete block for small garage construction.

The association officials have worked on this for several years and are to be congratulated on their final success.

This action will help to bring up the total garage construction in this type of masonry, which has not been as large as the merit of the material deserves.

Fireproof Quality of Products Must Be Recognized

FIRE insurance on concrete masonry dwellings shows a surprising lack of uniformity over the country, according to rates now in effect by the various rating bureaus. Notwithstanding the comprehensive tests at the Underwriters' Laboratories in which concrete masonry walls were found to afford a very high degree of fire protection, in many places insurance rates on buildings of this construction are the same as on frame construction.

In other cases rates on identical construction vary from those on frame to the best rates afforded reinforced concrete or solid brick masonry. Quite obviously the fire resistance and salvage values of concrete block and tile walls, which are the elements on which rates are properly based, could not possibly vary to this extent.

Inequitable rates on concrete masonry construction continue in many sections of the country in spite of the fact that the rating bureaus are friendly. In several cases rating bureau officials have really expressed the opinion that some adjustment should be made.

But they also point out that their member insurance companies must receive an adequate revenue and that if the concrete masonry rates go down, rates on other material must go up. Rating bureau spokesmen seem to feel that state insurance commissions would very likely oppose an increase of any kind. There seem to be members of the insurance fraternity who think that it is better to continue a present imposition on the concrete block industry and on the owners of firesafe concrete houses than to attempt an adjustment which might lead to the necessity of justifying certain increases.

The attitude described above indicates faulty reasoning. More equitable rates on concrete masonry will remove an obvious handicap and help to promote a greater proportion of more fire resistant construction. Take residences, for example. Today not over 14% are built of all types of masonry—the remainder are frame fire traps. Increase the proportion of masonry homes only slightly and the fire losses will be decreased greatly.

Concrete block stand severe fire test under extreme conditions

That more equitable rates will help sell concrete masonry cannot be doubted. Many experiences in the laboratory, in test houses and actual dwelling and commercial building fires convince students of the situation that concrete masonry structures should be given a most favorable insurance rate. After full investigation rating bureaus in several important sections of the country have wisely granted the most favorable class of rates to concrete masonry dwellings. Their action provides plenty of argument for general action by all other rating bureaus in the same general direction. As a matter of good public policy and good business, prospective home owners should be encouraged to build of firesafe construction. More equitable rates throughout the country will prove one of the strongest helps in attaining this end.

Efficient Methods in Products Manufacture

AN operating chart is a great help to the manufacturer of concrete products, giving him an opportunity to visualize at a glance the course of his business.

Such a chart hangs over the desk of E. W. Dienhart, manager of the Acme Concrete Products and Gravel Co., Cement City, Mich., and he watches it with much interest to see the kinks come out of the lines traced thereon.

"On my chart are two lines," he says in *Sauerman News*, "one for daily production and the other for the cost of production per thousand tile. There have been many knots to untie in these lines, but I am happy to state that they are getting more and more consistent each month.

"It may seem strange to some operators that our products business has outgrown our sand and gravel business. In 1925 we took out 50,000 tons of material and made 750,000 tile. This year the manufacture of tile will go to over 2,000,000, while the material output probably will not perceptibly increase. We will simply divert more of the material into the manufacture of our building units, for which there is a more profitable market in this territory than there is for sand and gravel. If the demand for sand and gravel should suddenly expand at any time, we will be able to speed up to meet the situation, as our present schedule does not represent the full capacity of our excavating and screening equipment.

"All our materials for the tile plant are scientifically graded. Our supply runs very uniform, but we nevertheless make sieve tests almost daily. We have worked out a mix which uses our materials with practically no waste, giving a fineness modulus of 4.00 and making a product which has high strength, low absorption, good appearance and is economical in the extreme."

Mr. Dienhart was formerly with the Portland Cement Association, where his work was along the line of applying scientific knowledge to the manufacture of concrete products, including the production and preparation of the materials, so that on taking his present position two years ago he welcomed the opportunity offered of constructing a modern sand and gravel plant on the site of an earlier venture, and putting along with it a concrete products plant where building units might be manufactured under conditions which would make for minimum cost.

Cinder Block Plant to Be Built at Pueblo, Colo.

ANNOUNCEMENT is made in the Pueblo *Chieftain* of the organization of the Pueblo Cinder and Cement Products Co. with a capital of $100,000. The incorporators, all local men, are Harold Melton, Luther W. Creager, Earl E. Waters, Edward N. Walter, John D. Chamberlain, Charles E. Cummings and William B. Stewart.

The old "Hydro-Stone" plant at Tenth and Water streets has already been secured, and the officials of the company have started moving in machinery and material, getting ready for work.

Cinder blocks and other products made from cinders, as well as cement blocks, roofing tile and hollow tile, burial vaults and ice refrigerators are to be manufactured.

The cinder block proposition is said to be the second of its kind in the state. Denver has the other plant.

Plan Development of Slate and Marble Deposits

ANNOUNCEMENT is made in the Knoxville (Tenn.) *Sentinel* of the organization of the Southern Slate and Marble Co. to develop marble and slate deposits near Wildham, Blount county, Tennessee. The company has filed application for a charter, the capital stock being fixed at $330,000, of which $300,000 is preferred and $30 000 common.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.25@1.35	1.20@1.30	1.10@1.20	1.05@1.10	1.05@1.10
Munns, N. Y.	1.00	1.35	1.35	1.25		
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	
Walford, Penn.	.70	1.35	1.35	1.35	1.35	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Afton, Mich.			.50			1.50
Alton, Ill.	1.85		1.85			
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.00		1.10	.90	.95	.95
Chasco, Ill.	1.25					1.15
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	
			Flux 1.50@1.75			
Gary, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Greencastle, Ind.	1.30	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Milltown, Ind.		90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
Northern New Jersey	1.30		1.80	1.60	1.40	
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
St. Vincent de Paul, Que.	.75	1.25	.90	.85	.80	1.00
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Can. (k)	1.55	2.05	2.05	1.90	1.90	1.90
Stone City, Iowa	.75		†1.10	1.05	1.00	
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
SOUTHERN:						
Alderson, W. Va.	.50	1.50	1.40	1.30	1.20	
Allgood, Ala.		Crusher run, fines out, for flux, 1.00 per net ton				
Brooksville, Fla.	.75		2.65	2.65	2.40	2.00
Cartersville, Ga.	1.00	1.50	1.50	1.15	1.15	
Chico, Texas	1.00	1.35	1.30	1.25	1.15	1.10
El Paso, Tex.	1.00	1.00	1.00	1.00		
Ft. Springs, W. Va.	.50	1.60	1.50	1.35	1.25	
Graystone, Ala.		Crusher run fluxing stone. 1.00 per net ton				
Kendrick and Santos, Fla.		3½ in. and less, 1.00 per ton				
New Braunfels, Tex.	.30@1.00	1.00@1.30	1.00@1.30	.70@1.00	.70@ .90	
Olive Hill, Ky.	.50@1.00‡	1.00	1.00	1.00	1.00	1.00
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	2.00	2.00	2.00	2.00	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	1.25	1.25	1.25	1.10	
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.30	1.30	1.35	1.35	1.35	1.30

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.55	1.35	1.25	1.25
New Haven, New Britain, Meriden & Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.50	2.00	1.80	1.40	1.40	
Oakland and El Cerritto, Cal.	1.00	1.00	1.00	.90	.90	
San Diego, Calif.		2.75	2.55	2.35	2.35	
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	
Springfield, N. J.	1.60	2.00	2.00	1.70	1.60	
Toronto, Can. (k)		3.58@4.40	3.05@3.45			
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.—Granite	.50a		1.75@2.00	1.75	1.60	
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.—Granite	.75	2.00	1.75b	1.35		
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	
Middlebrook, Mo.	3.00@3.50		2.00@2.50	2.00@2.25		1.25@3.00
Northern New Jersey (Basalt)	1.50	2.00	1.80	1.40	1.40	
Richmond, Calif.—Quartzite	.75		1.00	1.00	1.00	
Somerset, Pa. (sand-rock)	1.85@2.00a		1.35@1.50		1.00@1.50	
Toccoa, Ga.—Granite	.50	1.50	1.50	1.40	1.35	1.35

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ½ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40. (k) on cars, less 5c per ton discount.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	1.50
Cartersville, Ga.—Pulverized, 2.25; 50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Texas.—50% thru 50 mesh, bulk	1.50
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Henderson, N. C. (paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Analysis $CaCO_3$, 56%; $MgCO_3$, 42%; 65% thru 200 mesh, bags	3.95
Bulk	2.70
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Joliet, Ill.—90% thru 100-mesh	4.24
Knoxville, Tenn.—Analysis, 52% $CaCO_3$, 37% $MgCO_3$; 80% thru 100 mesh; bags, 3.75; bulk	2.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; $MgCO_3$, 0.75%; 50% thru 100 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Toledo, Ohio, 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh, 2.10; 90% thru 50 mesh	1.65
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—50% thru 4 mesh	.50
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	3.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh		1.75
50% thru 4 mesh		1.50
Chasco, Ill.—50% thru 100 mesh		1.20
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh		.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh		1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh		1.35
Dundas, Ont.—Analysis, 53.8% $CaCO_3$; $MgCO_3$, 43.3%. 100% thru 10 mesh, 40% thru 50 mesh, 25% thru 100 mesh		1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh		1.50
Garnet, Okla.—All sizes		1.25
Kansas City, Mo.—50% thru 100 mesh		.75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh		2.00
Screenings (¼ in. to dust)		1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk		1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@	2.35
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh		1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh		1.50
Monroe, Mich. — Analysis, $CaCO_3$, 52.03%; 42.25% $MgCO_3$; 30% thru 100 mesh		2.30
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags		5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh		1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh		1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@	1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh		.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes		1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk		3.00
Joliet, Ill.—85% thru 200 mesh		4.25
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@	3.50
Rocky Point, Va.—80% thru 200 mesh; bags, 4.25@4.75; bulk	3.00@	3.50
Waukesha, Wis.—90% thru 100 mesh, bulk		4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W.Va.—Glass sand		2.25
Buffalo, N. Y.	2.00@	2.50
Cedarville and S. Vineland, N. J.—Damp		1.75
Dry		2.25
Columbus, Ohio	1.25@	1.50
Estill Springs and Sewanee, Tenn.		1.50
Franklin, Penn.		2.00
Gray Summit and Klondike, Mo.		2.00
Los Angeles, Calif.—Washed		5.00
Mapleton Depot, Penn.	2.00@	2.25
Massillon, Ohio		3.00
Mendota, Va.	2.25@	2.50
Mineral Ridge and Ohlton, Ohio		2.50
Oceanside, Calif.		3.00
Ottawa, Ill.	.75@	1.25
Pittsburgh, Penn.	3.00@	4.00
Red Wing, Minn.: Bank run		1.50
Ridgway, Penn.		2.50
Rockwood, Mich.	2.75@	3.25
Round Top, Md.		2.25
San Francisco, Calif.	4.00@	5.00
St. Louis, Mo.		2.00
Sewanee, Tenn.		1.50
Thayers, Penn.		2.50
Utica, Ill.	1.00@	1.25
Zanesville, Ohio		2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.50@ 1.75
Columbus, Ohio		.30@ 1.00
Dresden, Ohio		1.00
Eau Claire, Wis.	4.25	.60@ 1.25
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

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Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	
Montoursville, Penn.	1.00	1.00	1.00	.75	.75	.75
Northern New Jersey	.40@ .50	.40@ .50	1.25	1.25	.90@1.25	
Olean, N. Y.		.75	.75		.75	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Pa.		1.85			1.50	
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.40@ .50	.40@ .60	.20@ .50	.50@ .60	.60	.55@ .60
Barton, Wis.		.75		.75	.75	.85
Chicago, Ill.	.70	.60	.50	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Iowa		.40	1.50			
Eau Claire, Wisc.	.60@1.25	.45	.85@1.25		.95	
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.40	.40	.50	.50	.40	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Haven, Mich.		.60@ .80		.60@1.00		.60@1.00
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Jedbury and St. Louis, Mo.	.75	.90	1.00	.90	.90	.90
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.45	1.35
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.70	.70			1.60	
Oregon City, Ore.		1.25	1.25	1.25	1.25	1.25
Palestine, Ill.	.75	.75	.75	.75	.75	.75
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
Terre Haute, Ind.	.75	.60	.90	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.		All sand, 1.40.		All gravel, 1.50.		
Chattanooga, Tenn.		1.65			1.45	
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.	.60@ .70					
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
Lindsay, Texas					.55	
Macon, Ga.	.50	.50				
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.50	.40	2.25	1.25	1.00	
WESTERN:						
Kansas City, Mo.	1.00	.70				
Los Angeles, Calif. (points all around) (d)	.60	.50	.85	.85	.85	.85
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.00*	2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.65		1.35		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
East Hartford, Conn.			Sand, .75*			
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas		.95				.55
Grand Haven, Mich.						.80
Grand Rapids, Mich.				.60		
Hamilton, Ohio					.70	
Hersey, Mich.				.55		
Indianapolis, Ind.		Mixed gravel for concrete work, at .65				
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Lindsay, Texas						.55
Macon, Ga.	.35	.35				
Mankato, Minn.			Pit run sand, .70			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.						.60
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Waukesha, Wis.	.60	.60	.60	.60	.60	.64
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.00	1.10				

(a) ¾ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25			4.00	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	2.00@2.25	2.00		1.75	2.00@2.50		1.75
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.50@2.00	1.25@1.50	2.00@2.50	.30@1.50	1.50@2.00	2.75@3.50	1.50@3.00
Dresden, Ohio	1.40	1.50	1.50	1.25	1.50		
Eau Claire, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75		1.75			
Kasota, Minn.							1.10a
Klondike, Mo.	1.75		2.00	1.75	1.75		1.25
Mapleton Depot, Penn.	2.25	2.00		2.00	2.00	2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.30@ .35			
Montoursville, P'n.				1.25@1.35			
New Lexington, O.	2.00	1.50					
Ohlton, Ohio	1.75*	1.75*	2.00*	2.00*	1.50*	2.50*	1.75*
Ottawa, Ill.	2.50		2.50	1.25	.75	3.50	3.50
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.	1.50	1.50		1.60		2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.¶		.50@.85	.50@.90	.60@.75	.60@.90		
Utica, Ill.	.75	.65		.75	.75		
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	1.75*@2.25	1.75*		1.75*@2.25			
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) delivered.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium nd Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern, N. J.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.45*	1.80*	1.45*	1.45*	1.45*	1.45*
Jackson, Ohio		1.05*		1.30*	1.00	1.30*	1.30*
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	1.55*
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50_2
Lime Ridge, Penn.							5.00a	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Carey, Ohio	12.50	8.50	8.00		9.00		8.50	1.50
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio	15.00	8.50	8.50	9.00			7.50	1.50
Frederick, Md.		9.50	9.50	9.50	8.00	9.50	7.50	1.45e
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.50	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50				9.50		9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.00	13.50	9.00	11.00_1	9.00	1.50c
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.							8.00	
Graystone, Ala.	12.50	10.00		12.50			8.50	1.50
Keystone, Ala.		10.00	10.00	10.00	8.50	1.45u	8.50	1.50
Knoxville, Tenn.	20.25	10.00	10.00	10.00			8.50	1.50
Ocala, Fla.		13.00	10.00			1.60	12.00	1.70
WESTERN:								
Calcite, Colo.							9.25	
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50_4
San Francisco, Calif.	19.50@21.00	18.00@20.00	15.00	18.50			14.00_5	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (¶) to 10.00; ($_1$) 80-lb. paper bags; ($_2$) to 3.00; ($_3$) to 9.00; ($_4$) to 1.60. ($_5$) to 16.00; ($_6$) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Mineral Ridge and Ohlton, Ohio	*1.75	*1.75
Montoursville, Penn.		1.25
Ottawa, Ill.	1.25	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 3.00	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point,

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons	.08
per gross	1.25
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	8.50@10.00
Including bags	9.50@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags; 325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	8.75@16.00
Joliet, Ill.:	
Roofing talc, bags	10.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300 mesh), bags	13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 75%	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.25@ 8.25

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%	8.00@10.00
Twomey, Tenn.—B.P.L. 65%	8.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton,	
68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75
72% min. B.P.L., Basis 72%	4.25
75/74% B.P.L., Basis 75%	5.25
77/76% B.P.L., Basis 77%	6.25

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00@150.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—per ton, mine run	360.00
Mine scrap	24.00
Clean shop scrap	27.00
Dry ground, 20 mesh	28.00
40 mesh	35.00
60 mesh	40.00
100 mesh	60.00
200 mesh	80.00
Roofing mica	27.00
Punch mica, per lb.	.10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink		†6.00
Buckingham, Que.—Buff stucco dash		‡12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica Spar		8.00@10.00
Easton, Penn., and Phillipsburg, N. J.	10.00@16.00	10.00@16.00
Haddam, Conn. — Fel-stone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash		6.00@18.00
Middlebrook, Mo.—Red		20.00@25.00
Middlebury and Brandon, Vt.—Middlebury white		‡9.00
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Stockton, Calif. — "Natrock" roofing grits		15.00@20.00
Tuckahoe, N. Y.		12.00
Villa Grove, Colo.		13.00
Warren, N. H.—cement facing (mica), per ton		7.50
Wauwatosa, Wis.		16.00@45.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Bath, Me.—Color, white; analysis, potash, 12%; 100% thru 180 mesh, bags, 21.00; bulk	18.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk	6.75@ 7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 95% thru 200 mesh, bags included, carloads..	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 98% thru 200 mesh, bags	21.00
Bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Pa.—Color, white to light cream; 98% thru 150 mesh, bags, 11.00@13.00; bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk (Bags 11 cents each, non-returnable)	16.00
Wheeling, W. Va.—Color, white; analysis, K_2O, 9.50%; Al_2O_3, 16.70%; Na_2O, 3.50%; SiO_2, 69.50%; 99% thru 140 mesh, bulk	19.00

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk	16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	12.00‡
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Los Angeles Harbor (limestone), 100-lb. sack, 1.00; sacks, per ton, 8.50@9.50†; bulk, per ton	6.00@7.00†
Toughkenamon, Pa.—(Feldspar) 100-lb. bags, 1.00; bulk, per ton	10.00
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren, N. H.—(Mica) per ton	7.70@7.90‡
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.00*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.50@13.50
Detroit, Mich.	16.00@17.50
Farmington, Conn.	17.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	13.00
Lancaster, N. Y.	13.00
Madison, Wis.	†a14.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.00
Portage. Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	19.75
Saginaw, Mich.	13.00
San Antonio, Texas	16.00
Sebewaing, Mich.	12.00
Syracuse, N. Y.	20.00
Toronto, Canada	13.00@15.60†
Toronto, Canada	13.00
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Delivered in city limits. ‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O.M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.		3.37
Atlanta, Ga.		2.35
Baltimore, Md.		1.70@2.35
Birmingham, Ala.		2.30
Boston, Mass.		1.81@2.63‡
Buffalo, N. Y.		1.67@2.38‡
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.34‡
Charleston, S. C.		2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	.56¾	
Cleveland, Ohio		2.29‡
Chicago, Ill.		2.10‡
Columbus, Ohio	.57½	
Dallas, Texas		2.10
Davenport, Iowa		2.29‡
Dayton, Ohio	.57	
Denver, Colo.	.66¼	2.65
Detroit, Mich.		2.15‡
Duluth, Minn.		2.09‡
Houston, Texas		2.60
Indianapolis, Ind.	.53½	
Jackson, Miss.		2.60
Jacksonville, Fla.		2.20
Jersey City, N. J.		1.85@2.33
Kansas City, Mo.		1.92
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.54¼	
Memphis, Tenn.		2.60‡
Milwaukee, Wis.		2.25‡
Minneapolis, Minn.		2.32‡
Montreal, Que.		1.36
New Orleans, La.		2.20
New York, N. Y.		1.77@2.25‡
Norfolk, Va.		2.17
Oklahoma City, Okla.		2.46‡
Omaha, Neb.		2.36‡
Peoria, Ill.		2.27‡
Philadelphia, Penn.		1.85@2.41‡
Phoenix, Ariz.		2.91
Pittsburgh, Penn.		2.09‡
Portland, Colo.		2.80
Portland, Ore.		2.80
Reno, Nevada	.75¼	3.01
Richmond, Va.		1.69@2.44
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.		2.31‡
Savannah, Ga.		2.50
St. Louis, Mo.	.55	2.20‡
St. Paul, Minn.		2.32‡
Seattle, Wash.	10c discount	2.65
Tampa, Fla.		2.25
Toledo, Ohio		2.20‡
Topeka, Kans.		2.41‡
Tulsa, Okla.		2.33‡
Wheeling, W. Va.		2.17
Winston-Salem, N. C.		2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents less to dealers.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.		1.85
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.35
Davenport. Calif.		2.05
Detroit, Mich.		2.15
Hannibal, Mo.		2.05
Hudson, N. Y.		2.05
Leeds, Ala.		1.95
Mildred, Kans.		2.35
Nazareth, Penn.		1.95
Northampton, Penn.		1.95
Richard City, Tenn.		2.05
Steelton, Minn.		1.90
Toledo, Ohio		2.20
Universal, Penn.		1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u					11.70u			
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50			13.50			
Detroit, Mich.‡				11.30	11.30	11.30		8.00					
Delawanna, N. J.						8.00		8.25@9.40			.14½s	.15½s	40.00@41.00
Douglas, Ariz.			7.00			15.50d	18.50		30.00	15.50			
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50		24.55	20.00			
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	19.00	7.00	27.00	19.00		15.00	30.00
Hanover, Mont.				11.80									
Los Angeles, Calif.			10.40k	11.40k									
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00		20.00	30.00
Portland, Colo.				10.00									
San Francisco, Calif.					14.40r		15.40r						
Seattle, Wash.	6.50		11.00	16.00									
Sigurd, Utah									21.50				
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00					20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (i) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	8x8x16	8x10x16	8x12x16
	Sizes		
Camden, N. J.	17.00	......	......
Columbus, Ohio	.16@.18a	......	......
Detroit, Mich.	.16	......	.26
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15	......	......
Graettinger, Iowa	.18@.20	......	......
Indianapolis, Ind.	.14@.16†	......	......
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a	......	......
Olivia and Mankato, Minn.	9.50b	......	......
Somerset, Penn.	.20@.25	......	......
Yakima, Wash.	20.00*	......	......

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00

Chicago, Ill.—per sq. 20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate Red and Orange	Green Blue	Yellow, Tan and Slate Gray
French and Spanish†	$11.50	$13.50	$12.75
Ridges (each)	.25	.35	.30
Hips	.25	.35	.30
Hip starters	.50	.60	.60
Hip terminals, 2-way	1.25	1.50	1.50
Hip terminals, 4-way	4.00	5.00	5.00
Mansard terminals	2.50	3.00	3.00
Gable finials	1.25	1.50	1.50
Gable starters	.25	.35	.30
Gable finishers	.25	.35	.30
*End bands	.25	.35	.30
*Eave closers	.06	.08	.06
*Ridge closers	.05	.06	.05

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.	18.00
Indianapolis, Ind.—9"x15"	
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x4x12	40.00
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00

Longview, Wash. (Stone Tile)	Per 1000
4x8x12	65.00
Mt. **Pleasant, N. Y.:**	**Per 1000**
5x8x12	**78.00**
Grand **Rapids, Mich.:**	**Per 1000**
5x8x12	**70.00**
Houston, Texas:	
5x4x12 (Lightweight)	**45.00**
5x8x12 (Lightweight)	**80.00**
Pasadena, Calif.—(Stone Tile	Per 100
3½x4x12	3.00
3½x6x12	5.00
3½x8x12	6.00
Wildasin Spur, (Building Tile) Los Angeles, Calif.:	**Each**
4x3½x12	**.03½**
6x3½12	**.04½**
8x3½x12	**.05½**
Yakima, Wash.—Building tile:	
5x8x12	**.10**

Cement Drain Tile

Graettinger, Iowa drain tile per 100 ft.

5-in	4.50
6-in	5.60
8-in.	9.00
10-in.	12.00
12-in.	17.50
14-in.	25.00
16-in.	35.00
18-in.	45.00
20-in.	60.00
22-in.	70.00
24-in.	80.00
30-in.	100.00

Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	**9.00**

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	**15.50**	**22.00@50.00**
Camden and Trenton, N. J.	**17.00**	
Ensley, Ala. ("Slagtex")	**14.50**	**22.50@33.50**
Eugene, Ore.	**25.00**	**35.00@75.00**
Friesland, Wis.	**22.00**	**32.00**
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	14.00@15.00	27.00@100.00
Mt. Pleasant, N. Y.		**14.00@23.00**
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	**12.50**	
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	22.50
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	**16.50**	**32.50@125.00**
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	21.00@42.00
Westmoreland Wharves, Penn.	15.00	20.00
Winnipeg, Man.	14.00	**22.00**
Yakima, Wash.	**22.50**	......

†Gray. ‡Red.

Greenville Engineering Service Changes Name

THE consulting engineering department of the Greenville Gravel Corp., Greenville, Ohio, will in the future operate under the name of F. M. Welch Engineering Service. Other than the change in name the arrangement remains the same, F. M. Welch still being chief engineer of the Greenville corporation.

The success in designing and operating the 12 to 15 gravel plants of the Greenville company under the various conditions that prevail throughout Ohio, Indiana and Michigan brought frequent requests from new or smaller companies for engineering assistance. The company extended this as an accommodation at first and then as the requests increased, it was decided to put this service on a commercial basis. A department known as the "Consulting Engineering Department of the Greenville Gravel Corp." was created for this purpose with F. M. Welch in charge.

The success of this department may be attributed greatly to Mr. Welch, who is one of the prominent engineers in the rock products industry, having been engaged in the designing and building of sand and gravel plants for the past 20 years. Before associating with the Greenville company in 1918, Mr. Welch was connected with the Link-Belt Co. and the Stephens-Adamson Co. and for seven years was head of the sand and gravel department of the Webster Mfg. Co., Chicago.

Columbia Quarry Company Gets 2,250,000 Ton Order

WE have received first-hand information that the Columbia Quarry Co., St. Louis, Mo., of which E. J. Krause is president, has recently made a contract to supply all the fluxing stone requirements of the St. Louis Coke and Iron Co., for their new steel plant. The minimum requirement will be 2,250,000 tons during the 12-year life of the contract, with the probability of increasing in event more furnaces are erected by the steel company. The size of the stone contracted for ranges from 1 in. to 5 in.

The Columbia Quarry Co. operates plants at Columbia, Krause, Maeystown and Valmeyer, Ill.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17⅕	......	.40	.50	.60	.70	......	......	......	......	......	......	—
G'd Rapids, Mich. (b)	......	......	......	.60	.72	1.00	1.28	......	......	1.92	2.32	3.00	4.00	5.00	6.00	......	—
Houston, Texas	......	.19	.28	.43	.55½	.90	1.30	......	†1.70	2.20	......	......	......	......	......	......	—
Indianapolis, Ind. (a)	......	......	......	.80	.90	1.10	1.30	......	......	1.70	......	2.70	......	......	......	......	—
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	......	......	......	......	......	......	......	......	......	1.50	1.75	2.50	3.25	4.25	......	......	—
Olivia & Mankato, Minn.												12.00 per ton					
Paullina, Iowa‡	......	......	......	......	......	......	......	2.25	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Somerset, Penn.	......	......	......	......	1.08	1.25	1.65	......	......	2.50	......	3.65	4.85	7.50	8.50	......	—
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.80	......	......	......	......	......	......	......	......	......	—
Tiskilwa, Ill. (rein.) (a)	......	......	......	.65	.75	.85	1.10	1.60	......	1.90	......	......	3.40	......	......	......	—
Wahoo, Neb. (b)	......	......	......	......	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.								12 in. to 60 in. 18.00 per ton									
Yakima, Wash.										$10.00 per ton							

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

State Cement Plant Operation From Two Angles

THE state owned cement plant at Rapid City, S. D., is once again under discussion. Since its inauguration it has served to prove or disprove, dependent on the way a person thinks about things, the success of public operation of enterprises usually run privately. Although we are not believers in the Socialistic doctrine that state or government-owned enterprise is either the correct or feasible policy, we submit as a matter of interest in connection with the following newspaper editorial, a clipping from a Rapid City, S. D., newspaper which contains an extract of the report of the secretary-treasurer of South Dakota on the finances of the state plant.

Why Pick on Cement?

An Editorial in the New York Commercial, July 9, 1926

Whenever government imposes itself on industry Socialism is in evidence. Wherever government owns, operates or controls any branch of industry Socialism is in operation. The former leads to the latter, and the latter leads to failure. In practically every state in the Union Socialism of this type is either in evidence or operation. "Industrial Socialism," if we be permitted to coin such a term, is rapidly growing in extent and influence throughout the country. The state of South Dakota presents, probably, the best example of applied Socialism that can be found in the United States. "Best" not only by reason of the number and size of the various Socialistic ventures entered into by that state but because of the outstanding results of all those ventures. Other states there are where Socialism has been tried on a grand scale, but so far as our knowledge extends no individual commonwealth has yet attained the batting average of South Dakota.

Among other ventures and adventures South Dakota has gone into the cement business, as Mr. Duncan has very ably told you in his series of articles, and as the state records very forcefully prove. Other than the fact that the state of South Dakota has large natural deposits of the various ingredients that enter into the manufacture of cement, and that the people of South Dakota have been led astray by the glowing promises and prophecies of Socialistic politicians, there is no very good reason why South Dakota should be in the cement industry at all. The cement consumption of the entire state is hardly large enough to justify an expensive plant. South Dakota is still in the mud so far as highways go, and her road building program in nowise is so ambitious as those of many other states. And in keeping with the experience of the cement industry there should be demand enough from highway construction to absorb 22% of the plant's output. Building construction, for reasons that are legion, is not overly active in South Dakota. Nor does anyone contemplate a heavy building boom in that state —at least of sufficient size to take 23% of the plant's production.

The manufacture of cement, because of the very nature of things, involves a heavy financial outlay. The manufacturing plants are necessarily large, the engineering and scientific involvement great, with the investment correspondingly heavy. The mere fact that no member of the cement industry has seriously considered South Dakota as a site for such a plant, despite the availability of raw material, should be sufficient evidence that the existing market would not justify a large cement plant. Indeed, few members of the cement industry are contemplating any kind of additional plants in any locality because the cement industry is over-equipped. Not to the extent that the coal industry is over-equipped, but at the present time the industry is capable of producing about 200,000,000 bbl. of cement, while the actual shipments for this year will probably not exceed 175,000,000 bbl. Last year the productive capacity of the industry stood at 190,000,000 bbl., and out of that capacity there came a production of 161,000,000 bbl., only 157,000,000 of which were shipped.

Cement is a very important industry. Its plant investment is now nearing the half billion mark. But the industry today is more worried over consumption than production since from the standpoint of actual demand the plant investment is nearly 20% higher than need be. In other words, the cement industry need operate at only 75 or 80% of capacity to fully meet the nation's requirements. To be equipped to handle slight increases in demand is not an unhealthy condition for any industry, but it is a condition that permits of no expansion. Adding to the plant capacity of an industry already over-equipped can contribute nothing to the soundness of that industry.

We do not know whether the folk up in South Dakota knew of the over-equipped condition of the industry. If they did not, then there is evidence of a lack of proper research and investigation, and an indication that they fell down on the job in a way no private enterprise would—or could. If they did know of it, but still insisted upon plant addition, their actions would indicate a lack of sound judgment.

Some readers may ask, as they read: "Why pick on South Dakota?" The answer would be: "We are not picking on South Dakota; we are picking on Socialism. And so far as cement and other industrial ventures are concerned South Dakota and Socialism are synonymous. We are picking on Socialism because we think it should be picked on—picked to pieces—and well ventilated." Our question in the caption is directed to Socialists whether they be in Pierre or Paris: "Why pick on cement?" To do so indicates shallow thinking and unsound reasoning.

Cement Plant Clears $68,495 in Six Months

From the Rapid City Daily Journal, July 17, 1926

South Dakota's state cement plant earned a net profit of $68,495.24 during the six months period from January 1 to July 1, 1926, according to an official report forwarded to Governor Gunderson by Elmer C. Thorpe, secretary-treasurer.

The amount is over and above depreciation of the plant, upkeep, repairs, operating and all other expenses of the plant. It does not include interest charges on state cement plant bonds which amounts to $51,350. Deducting the latter, the net gain to the state of South Dakota through its operation of the cement plant for the six-months period is $17,145.24.

In discussing the report, Secretary Thorpe took occasion to refer to a recent attack made on the cement plant by R. E. Duncan, of New York, published in the *New York Commercial* and reprinted in certain South Dakota newspapers.

"The people of the state need not be alarmed at the attack made by this man Duncan," Mr. Thorpe told *The Journal*. "Duncan has attacked almost every institution in the state and he, an out-of-state man, has gone out of his way to make it appear that South Dakota is about the worst state in the Union. There must be a reason. All the people of South Dakota need to do is to keep their heads and insist on running their own affairs without interference from the outside.

"It is quite significant that this attack has been made on the cement plant fast on the heels of the announcement that the plant has returned to the state $100,000 in cold cash out of earnings. It would appear that the alarm is on the other side of the fence.

"Perhaps it would be well for South Dakota folks to ask, 'Who is this man Duncan? Why has he such an absorbing interest in South Dakota affairs?'

"Let the people remember the cement plant is in the hands of men who are citizens and taxpayers of this state who are making an honest effort to take care of the interests of the state. The cement commission is proud of the fact that every department of the state is boosting for the cement plant. So are most of the people. Yet no other department of the state is putting up a cent extra of the taxpayers' money to relieve the cement plant of any expenses belonging to it. The plant is proving a success, keeping a lot of money in the state which formerly went outside, giving employment to over a hundred families, developing a natural resource, making the highest possible grade of portland cement, and the people are beginning to realize the state owns an industry which is paying its own way and making an additional source of revenue to the state."

New Machinery and Equipment

New Multiple Unit Vibrating Screen

THE Robins Conveying Belt Co. has recently announced the addition to its line of screening equipment for sand, gravel, crushed stone and similar material, the Vibrex screen. It is claimed that this unit possesses the important feature of extreme simplicity, together with a number of distinct advantages which are not found in combination in any other similar unit.

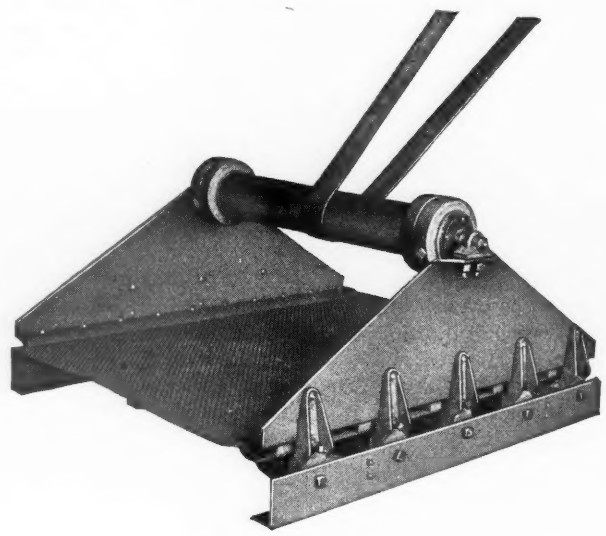
The new vibrating screen consists of three main parts: a vibrator driven by belt from motor or countershaft; a live screen frame, and a stationary base frame which may be readily attached to supporting structures.

Four adjustable unbalanced collars mounted on the vibrator drum give a variable amplitude of vibration to meet different conditions. The drum itself is carried by means of Timken roller bearings on a transverse shaft rigidly connected to the live screen frame.

The screen frame is connected to the base frame by ten coil springs, which perform the double function of absorbing the vibration of the screen and maintaining tension in the screen cloth proper, which is clamped in readily removable grips.

The fact that the entire screen frame is uniformly vibrated, it is claimed, eliminates dead and inactive areas of screen surface and insures long life of screen cloth, as there is no flexing of the individual screen wires. The supporting springs are said to minimize escaping vibration and consequent power loss, the unit requiring less than 1 hp. to operate.

The manufacturers recommend that a spare set of clamp plates be kept on hand and secured to the new cloth in advance, it then being possible, it is said, to remove the worn-out cloth and set the new one in its place in less than 15 minutes.



New vibrating screen

Maintenance, the makers say, is low, only two points, one at each end of the vibrator shaft, requiring lubrication with an alemite gun at intervals of one month.

Where desired the Vibrex screen is constructed with the drive motor secured to a platform mounted on the base frame, thus forming a self-contained unit. It may also be equipped at slight extra cost with an enclosing structure for the prevention of escaping dirt and dust. Where large capacities are to be handled, convenient multiples of the individual screen unit can be readily obtained from the manufacturers.

Improved Walking Device

THE Monighan Machine Co., Chicago, Ill., announce that they have introduced new ideas in the walking device of their draglines which are said to make their operation more efficient. The makers claim the following advantages for the improved design:

Machine cannot misstep no matter what position it may be in.

Cam can never leave track.

Cam has considerable of its bearing area in contact with track, especially when lifting machine, insuring long service and minimum wear of cam and track.

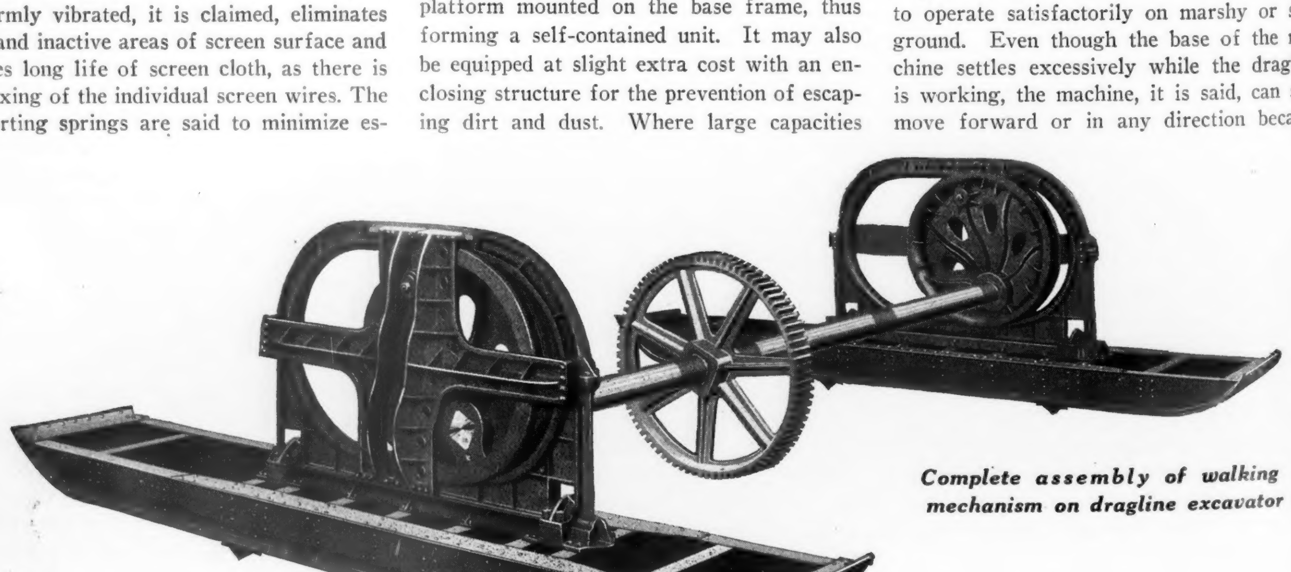
Substantial guide attached to track frame is provided so that track is always in alignment with cam.

The walking platform or shoe is hinged on the track frame, allowing shoe to pivot freely when moving over rough ground, avoiding excessive strains on frame and cam.

Track and cam are constructed so that a smooth lifting and moving action is secured, avoiding shocks to the machine.

The improved walking device, it is claimed, makes it possible for the Monighan machine to move satisfactorily over rough ground without the assistance of a clearing gang. The walking platforms pivot freely, as shown in the small illustration, and are thus, it is said, able to adapt themselves to very rough footing.

The circular base of the machine has a large bearing area which is said to enable it to operate satisfactorily on marshy or soft ground. Even though the base of the machine settles excessively while the dragline is working, the machine, it is said, can still move forward or in any direction because



Complete assembly of walking mechanism on dragline excavator

its treads are raised clear of the ground while excavating and they are always set on fresh, untrodden ground when ready to move.

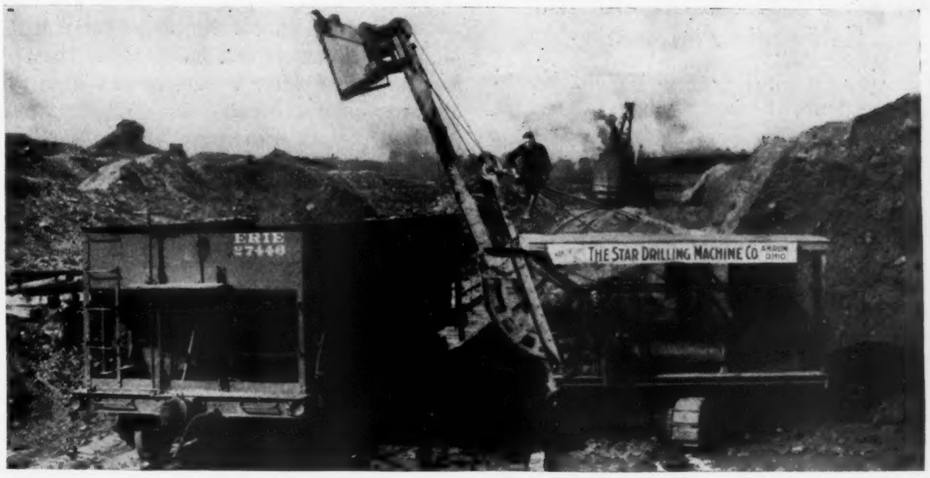
The improved walking device is being used

Position of auxiliary platform when walking on inclined surface

on all new Monighan machines, which are built in sizes from 1 to 6 cu. yd., inclusive, and can also be applied to Monighan machines in service.

Power Shovel for Stripping

ALTHOUGH the "Star" power shovel has been largely used by contractors for grading, the manufacturers, the Star Drilling Machine Co., Akron, Ohio, believe it can be used for stripping in the sand and gravel or crushed stone industries. The shovel, which weighs about 14 tons, is of full revolving type mounted on full-length crawler tractors and is equipped with three different kinds of buckets of ¾-yd. capacity. There



Small power shovel for stripping

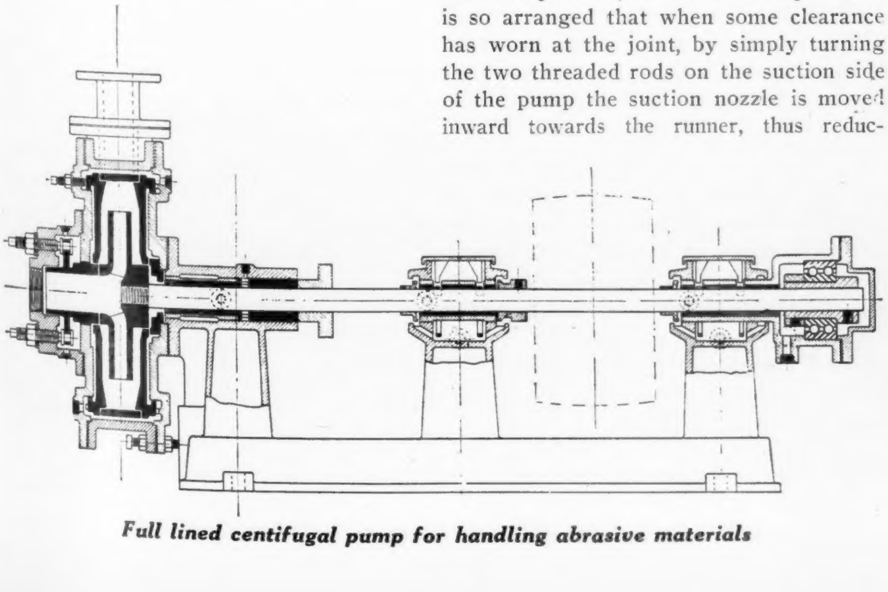
is no boom on shoveling or grading attachments and by telescoping the bucket back into the machine, it is said that the shovel can be made to revolve in a radius of 10 ft. 3 in.

Power is obtained from a Waukesha four-cylinder gasoline motor, type GU, rated at 60 hp. at 1000 r.p.m. Accessories include a vacuum system and self-starter and a good-sized gas tank. The digging radius is said to be about 21 ft. and the maximum dumping elevation, 17 ft. The capacity of the shovel, it is said, is from two to three buckets of the skimmer type per minute.

New Full-Lined Sand Pump

A FULL-LINED centrifugal pump for handling sand and other abrasives that is said to eliminate to a great extent troubles caused by wear on the lines, is announced by the Keogh Pump and Machinery Co., San Francisco, Calif. This new type has an impeller of the closed type with full shrouded sides, having a hub on the inlet side only, and which forms a face contact with the front side liner. To compensate for the wear at this running joint and thus, it is said, maintain efficiency and capacity, the makers have provided a "wear take-up." This is so arranged that when some clearance has worn at the joint, by simply turning the two threaded rods on the suction side of the pump the suction nozzle is moved inward towards the runner, thus reducing the clearance to normal and allowing the pump to operate at the maximum efficiency. This adjustment, it is said, can be made while the pump is in operation and until the suction nozzle is so worn that it must be replaced. The impeller, it is said, has thick walls and vanes and is cast with a soft steel bushing in the hub which is bored out and threaded to the shaft, permitting its removal and reinstallation without dismantling the pump. The pump liners are made of special hard metal without any through bolts or screws passing through them, and ground to fit. The stuffing box bearing is provided with lantern ring for water circulation and the thrust box bearing is of the ball type, entirely enclosed, running in oil.

The pump will operate under a vacuum and the capacity can be varied by varying the speed, and solid pieces of fair diameter can be sucked through if necessary. This permits, the makers say, the handling of other materials such as clay, etc., with this type of pump.



Full lined centifugal pump for handling abrasive materials

Trade Literature

General Electric Bulletins. GEA-405, on constant speed induction motors for elevator service. Illustrates and describes squirrel cage types KTE (3 phase) and KQE (2 phase), 60 cycles; **GEA-435,** describing multi-speed induction motors for elevator service; **GEA-19B** on CR7006-D4 and D5 a. c. enclosed magnetic switches for starting small single, two and three phase a. c. motors; **GEA-416** on automatic starting compensators for squirrel cage induction motors; **GEA-372** on explosion chambers for high-voltage oil circuit breakers; **GEA-135** on the 2300 volt, 90 in. a. c. switchboard; **GEA-319** on outdoor station equipment and **GEA-185** on type CR1049 manual contactors for a. c. and d. c. motors. GENERAL ELECTRIC CO., Schenectady, New York.

Welding and Cutting Equipment. Catalog No. **172-C,** a complete bulletin on the entire line of Milburn apparatus. Illustrated throughout. ALEXANDER MILBURN CO., Baltimore, Md.

Galion Mono-Veyor. Bulletin illustrating and describing typical installations of the Galion Mono-Veyor for handling coal or other materials. Description and illustrations of apparatus and details of construction. GALION IRON WORKS AND MFG. CO., Galion, Ohio.

Sullivan Gas Compressors. Bulletin **83-C** on the **WG-6,** single stage; **WI-3** and the **WJ-3,** angle type. Construction details and design, illustrations, etc. SULLIVAN MACHINERY CO., Chicago, Ill.

New President of Southern California Association

CLINTON B. ROGERS, recently elected president of the Southern California Rock Products Association, is general manager of the Reliance Rock Co., Los Angeles, Calif., and has had a rounded experience in the merchandising of building materials, particularly portland cement.

It was in 1910 that Mr. Rogers first became associated with the cement industry, at which time he joined the Lehigh Portland Cement Co. as salesman in the Chicago territory. His previous work had been with the National Fireproofing Co. at Pittsburgh, Penn. After three or four years actively selling cement to the trade, Mr. Rogers was called into the Chicago office of the Lehigh of the Lehigh company, where for two years he studied and became thoroughly familiar with all phases of office work necessary in such a large organization.

C. B. Rogers

In 1914 Mr. Rogers became district manager of the Lehigh Cement Co. in the Spokane, Wash., territory, assuming complete charge of the work at that office.

A change in executives at the Chicago office called Mr. Rogers back to the Windy City in 1919 as assistant secretary and treasurer in charge of credits.

In 1921 the Sandusky Cement Co. found itself in need of a sales manager and eagerly scanned the field for the best possible man for that position. The offer was made and accepted by "Roge," as he is known in the cement industry, and from that time until he left the central states for the Golden West, he continued as head of the sales department of the Sandusky company. It was quite a shock in and out of the cement industry when, at the December, 1924, meeting of the Portland Cement Association, it was learned that "Roge" had definitely decided to leave the cement industry and cast his destiny with the rock producers of the west. It was at that time that he became general manager of the Reliance Rock Co. of Los Angeles.

Mr. Rogers is quite a golfer. In fact, golf is his hobby and he holds the distinction of being the first man to have his name placed on the cup that the Portland Cement Association puts up each year during its golf tournament.

While with the Sandusky Cement Co. he became an enthusiastic booster of the use of white portland cement for ornamental and high-grade concrete and his work in boosting the use of white cement carried him to all parts of the country and brought him in close contact with many of the leading cement men and practically all of the prominent building supply dealers of the country.

As a member of the Portland Cement Association, he attended every meeting and devoted considerable time to committee work which had for its object the improvement and better merchandising of cement.

Doing a Valuable Work

STANTON WALKER, director of the engineering and research division of the National Sand and Gravel Association, finds time occasionally to get out and address a gathering of engineers and contractors. This is an important work, as much can be accomplished in this kind of man-to-man contact.

One such address, given at two points in Michigan, was on "Importance of Uniform Aggregates in Control of Concrete Mixtures," and now has been published in pamphlet form as one of the bulletins of the association.

Mr. Walker has given a large amount of data to prove his three conclusions:

(1) Properly prepared aggregates almost always require less cement than unprepared aggregates.

(2) The lack of uniformity of unprepared aggregates makes it extremely difficult to control the proportions in such a way as to produce concrete uniform in quality.

(3) The presence of organic impurities in aggregate should bar it from consideration for concrete work of any importance.

The importance of having a message such as this delivered in person, where the speaker can meet the arguments and answer the questions of engineers and contractors, cannot be overestimated.

End Investigation of New York Sand and Gravel Association

A REPORT in the Brooklyn *Times* states that the recent probe of the Greater New York Sand and Gravel Dealers' Association has been terminated. The investigation was carried out under the direction of Deputy Attorney-General Ullman to determine whether the association was a monopoly and aimed to fix prices on sand and gravel and restrict competition in Kings county. (See May 15 and May 29 issues for complete details on personnel of the association and earlier investigation reports.)

The Association, Mr. Ullman said, has agreed that it will fix no silica sand prices in the future, and will limit its activities to conducting a credit bureau.

Missouri Pacific Establishes Minerals Bureau

W. M. WEIGEL, who for the past five and one-half years has been mineral technologist of the United States Bureau of Mines at their southern experiment station at Tuscaloosa, Ala., and Washington, D. C., has accepted a position with the Missouri Pacific R. R. Co. His headquarters will be at the offices of the railway company, Railway Exchange Building, St. Louis, Mo.

The Missouri Pacific R. R. under its present progressive management realizes that the prosperity of the railway depends upon the prosperity and growth of the country which it serves, and as mineral commodities constitute a very large percentage of all railway freight traffic, it is only natural that the railway company wishes to be as helpful to the producers and consumers of mineral products and owners of undeveloped mineral properties as is possible. With this plan in mind Mr. Weigel will make a study of the mineral resources of all kinds in the Missouri Pacific territory with the object of assisting the producer and consumer in any legitimate way.

Mr. Weigel will be remembered by ROCK PRODUCTS readers as the author of various articles on special sands and gravel. His specialty at the Bureau of Mines has been the more common non-metallics or rock products.

U. S. Gypsum Company Opens New Stucco Plant

ANNOUNCEMENT is made at the Chicago office of the United States Gypsum Co. of the opening at New Canaan, Conn., of a new mine, quarry and plant for the production of marble to be used in the manufacture of "Oriental Stucco" and "Plastint" colored finishing plaster. The New Canaan operations are carried on on a large tract of land purchased this year and located about two miles from the New York, New Haven and Hartford railway.

This new plant has been necessitated by the increased demand throughout the United States for the colored stucco and tinted plaster in which the marble is used. The marble rock after being mined or quarried is put through primary and secondary crushers, then is graded over a bank of screens and separated into six different sizes. The correct percentage of each of these sizes is mixed together to produce stucco and tinted plaster of the right plasticity, water-carrying capacity and other qualities.

The output of the new plant is being shipped in bags to the company's other plants where it is compounded with mineral pigments and other ingredients to make the finished products. The works at New Canaan permit the company to exercise exact control over its stucco and tinted plaster.

Big New Sand and Gravel Enterprise at Portland, Oregon

THE Ross Island Sand and Gravel Co., Portland, Ore., on June 25 closed negotiations for the purchase of a controlling interest in the Beaver Portland Cement Co. of Portland and Gold Hill for a figure close to $800,000.

D. L. Carpenter, president of the Beaver Portland Cement Co., was elected president of the Ross Island Sand and Gravel Co. also. The newly elected directors include prominent Portland business men. Harold Blake was elected vice-president in charge of Ross Island operations; W. H. Muirhead, vice-president in charge of production for the Beaver Portland Cement Co., and the directory board of both companies includes Jay Bowerman, J. O. Elrod, Frankling T. Griffith, R. W. Hagood, Ross Hammond, George McDowell, Ralph H. Schneeloch and Coleman H. Wheeler, Jr.

J. O. Elrod purchased Ross Island last November on behalf of himself and associates. The island is situated in the Willamette river near Portland and contains large deposits of first class sand and gravel. The property includes Ross Island, Hardtack and Toe Islands, and contiguous acres amounting to a total of about 400 acres.

According to William G. Brown, consulting engineer, who made a survey for the companies, 13,670,000 cu. yd. of commercial gravel can be recovered from the properties. This, combined with sand suitable for building purposes, it is estimated, will bring the recoverable yardage up to more than 19,000,000 cu. yd.

The total assets of the Beaver Portland Cement Co., according to its last financial statement, amounts practically to $2,000,000, and the net assets to $1,521,767.55. It owns one of the largest cement properties in the Northwest, and operates an 1100-bl. plant at Gold Hill. Its limerock deposits in southern Oregon are so immense that it can operate at present capacity continuously for 100 years, according to official statement.

The two companies will maintain their corporate existence separately, but the sales activities, distributing organization and management will be under one head.

Approximately $300,000 will be spent by the company shortly for sand and gravel plants on Ross Island and for a huge suction dredge. A large amount of machinery for the plants has already been purchased and specifications for the rest are now nearly complete. Harold Blake, formerly managing owner of the Pacific Building Co., has charge of this part of operation.

Brown and Blake, consulting engineers, recently spent more than a month in eastern centers studying sand and gravel operations and plants.

President Carpenter states that control of the Beaver Portland Cement Co. was acquired by the purchase of 51.45% of the common stock and 68.24% of the preferred stock of the company.

McLean County, Illinois, Gravel Survey Completed

ACCORDING to a recent survey made by G. C. Broyhill, superintendent of highways, McLean county, Illinois, there are more than 71 gravel pits located within the county. The survey, however, is not quite complete; only those gravel beds known to exist being located. An examination of the beds of streams, Mr. Broyhill said, would reveal many other gravel sources.

Location of gravel pits reported so far are as follows: Bellflower, 7; Cheney's Grove, 7; Anchor, 3; Arrowsmith, 3; Martin, 3; Dawndale, 1; Yates, 1; Empire, 2; Blue Mound, 1; Lexington, 6; Chenoa, 3; Downs, 3; Old Town, 3; Towanda, 2; Money Creek, 1; Gridley, 2; Randolph, 1; Bloomington, 1; Hudson, 4; Funk's Grove, 7; Dale, 1; Dry Grove, 3; White Oak, 1; Mt. Hope, 2; Allin, 1; Danvers, 2.—*Bloomington (Ill.) Bulletin.*

Arrow Sand Company Expands

THE Arrow Sand and Gravel Co., Columbus, Ohio, through a deal consummated recently, will take over the property formerly owned by the old Franklin furnace plant in West Mound street, and contemplates the construction of a new plant to be opened by spring, it has been announced.

The company, according to its treasurer, W. H. Hoagland, also has leased city property extending from Greenlawn avenue bridge on the south to the furnace property on the north. The new plant is estimated to cost between $200,000 and $300,000. It is expected that the city will realize between $150,000 and $200,000 in royalties. With the removal of the sand and gravel deposits the city contemplates creating a municipally-owned lake for boating and swimming.—*Columbus (Ohio) Dispatch.*

Texarkana Gravel Company Sold

THE sale of the holdings of the Texarkana Gravel Co., Texarkana, Texas, to the P. W. Gifford interests of Dallas, Texas, is reported in a local newspaper. The consideration is said to be about $100,000. The Gifford interests are reputed to be one of the largest of their kind in the Southwest, with plants in many sections of Texas and Louisiana.

The Texarkana company has been in operation for about 12 years and has produced about 120,000 cu. yd. of crushed and screened gravel per year from pits at Sledge, Texas, using modern excavation and pumping equipment. J. S. Young was president of the company.

New Organization to Operate Near Brooksville, Fla., as Peninsula Rock Co.

APPLICATION has been made for a charter for the Peninsula Rock Co., to be capitalized at $600,000, with headquarters in Orlando and quarry near Brooksville, in Hernando county, according to J. O. Tilley, sales manager of the company.

The property containing the quarry was purchased for approximately $250,000 and a plant costing in the neighborhood of $350,000 will be put under construction within the next 60 days, the sales manager stated. It is expected to start full operation sometime during December next.

Tests made by the Southwestern Laboratories at Jacksonville of the rock to be quarried by the Peninsula Rock Co. show it to have an abrasion of only 3%, while the wear registered 11.1 and its analysis to be 36% lime, 53% silica, some aluminum and no impurities.

This rock, it is stated, is good for roads and all concrete work and is of such grade for railroad bed use that the Seaboard Air Line has contracted for all the overage of the company to be used as ballast in the building and maintaining of their roadbeds. The Seaboard company's business is expected to contribute largely to the success of the operation.

Leading business men of Florida and Oklahoma are reported to be backing the project. Some of the Florida men are H. M. Hampton, attorney, of Ocala; Baxter Morrison, owner of an ice plant at Inverness, and W. R. Ray, of Jacksonville, president of the Commercial National Bank of Ocala. These men formerly owned the quarry property and sold it to the company and then retained a large interest in it.—*Orlando (Fla.) Star.*

Gilbert A. Hanke Organizes Kent Gravel Company

GILBERT A. HANKE, who has managed the Battjes Building Material Co. for the last five years, has left that company and has organized the Kent Sand and Gravel Co., with offices at 336 Michigan Trust building, Grand Rapids, Mich.

The new company has purchased a tract of land near Butterworth road, and a modern washing plant has been installed. Mr. Hanke has also acquired the East Grand Rapids Sand and Gravel Co., on the Ada road, on which a number of improvements will be made.

Mr. Hanke is president of the new company, E. C. Eifert is treasurer, and I. C. Bradbury, secretary. The company's Ada pit is now in operation, while the Butterworth pit will be ready for operation within a short time.—*Grand Rapids (Mich.) News.*

News of All the Industry

Incorporations

Universal Gypsum Co., Chicago, Ill. Changed name to Universal Gypsum and Lime Co.

Standard Gypsum Co., Wilmington, Del., 10,000 shares of common stock of no par value.

McDonald Sand and Gravel Co., Seattle, Wash., $50,000. Elmer McDonald and D. D. Hartman.

Heltonville Limestone Co., Bedford, Ind., $75,-000. C. D. Donato, N. Donato and A. R. Wallis.

Texas Concrete Cement Pipe Co., Houston, Tex. Increased capital from $20,000 to $50,000.

Grant Marble Co., Grant, Va., $25,000. Eugene Transon and T. J. Carson, both of Sparta, N. C.

Lancaster Sand and Gravel Co., Buffalo, N. Y., changed name to East Aurora Sand and Gravel Co.

Jones & Hartley Cut Stone Co., Minneapolis, Minn., $50,000. Wm. Hartley, 722 East 24th Street.

Southern Slate and Marble Co., Maryville, Tenn., $330,000. T. W. Young, Jr., and J. E. Rowan.

Nashville Concrete Pipe Co., Nashville, Tenn., $25,000. F. W. Candy, 2812 Oakland Ave., Nashville.

Feeley Granite Co., Butte, Mont., $10,000. To operate a quarry near Feeley. A. S. Mooney, Sr., A. J. Wendel and Fayette Cannon.

Home Sand and Gravel Co., Lamanda Park, Cal. A. O. Nelson, E. B. Williams and R. C. Williams, all of Pasadena, Calif.

Sibley Cement Co., Sibley, Iowa, $10,000. G. F. Sokol, W. D. Shuttleworth, F. D. Reeves and others. To manufacture cement products, etc.

Vitreous Marble and Slate Co., New York, N. Y., $20,000. C. A. Hand, J. J. Dolan. (Filed by F. P. Woglom, 280 Broadway.)

Cail-Coe, Inc., Miami, Fla., $100,000. G. F. Cail, S. J. Coe and W. L. Read. To quarry, mine and deal in sand and gravel.

Artcraft Mosaic Co., St. Paul, Minn. To manufacture cement and concrete products. M. R. Franceschine, 3121 35th Ave. S., Minneapolis, Minn., and others.

Southern Ohio Quarries Co., Chillicothe, O., 205 shares of no par and 250 shares preferred stock of $100 par. G. W. Thompson, E. H. Davis, E. M. Marquard and others.

National Sand and Gravel Co., Inc., New Orleans, La., $100,000. G. W. Testard, 1324 Arabella St., New Orleans.

Asbestos Rock Plaster Co., Hackensack, N. J., $50,000. E. J. Hazard, Jr., J. E. Greer and W. N. Doyle. (Atty., B. R. Buffet, Bogota, N. J.)

Manhattan Lime Co., New York, $50,000. W. M. Young, H. W. Swan. (F. P. Ufford, 111 Broadway, New York.)

Yonkers Block and Concrete Co., Yonkers, N. Y., $12,000. S. W. Truman, J. and S. B. Frankfeldt. (Atty., B. W. Moore, Yonkers.)

Albemarle Soapstone Products, Inc., Cambridge, Mass.; deal in soapstone, etc. $1,000; 10 shares $100 each. Samuel Friedman, 190 Shore Drive, Winthrop, Mass., and Jack Friedman.

Gypsum Products Sales Corp., Wilmington, Del., $100,000. Reed Fuller, Bernhard Knollenberg, New York City; Austin T. Foster, Westfield, N. J. (Corporation Trust Co. of America.)

Hoosier Moulding Sand Co., Martinsville, Ind., $25,000. Producing and selling of moulding sands, clays and other products. Banas E. Neal, Silas C. Kivett and Bernice Guthridge.

McGrath Sand and Gravel Co., Lincoln, Ill., increased stock from $500,000 to $1,000,000 and increased directors from five to seven. Correspondent, McGrath Sand and Gravel Co., Lincoln.

Mount Pleasant Silica Sand Co., Cape May City, N. J., $40,000. To deal in sand, etc. William S. Vanzant, Harry P. Entriken, Frank Entriken, Sr., Cape May City, and others. (Atty., Samuel F. Eldridge, Cape May City.)

Quarries

Reliance Whiting Co., Alton, Ill., operating a quarry for getting out raw material for making whiting, has had a diamond drill bore made down in the rock of its quarry for a distance of 120 ft. The drill takes out a core of rock in 5-ft. lengths and these cores are preserved for study to determine the character of the rock through which the drill passed in making the exploration. E. A. Hermann, of the Reliance company, says that the exploration showed that there was rock enough of a suitable kind to carry on the business of the Reliance company for hundreds of years, since far down the rock showed a quality that was admirably adapted for the purposes of the company. Mr. Hermann said that there would be no more stripping of earth off rock in his company's quarry. Hereafter all the quarrying will be downward, as this can be done at less expense than for stripping off the earth and disposing of it. There is an advantage, too, the blasting does not throw rock over the neighboring territory nor does it make a noise that annoys those living near by, as it does when the blasting is done in the old way.

Florida Rock Products Co., Brookville, Fla., has almost completed a 50,000-ton storage yard at St. Petersburg, Fla. L. T. Porter is president and R. B. Murdock, vice-president.

W. E. Jewell, Okmulgee, Okla., has opened a new quarry about a mile south of the city.

Bettendorf Stone Co., Moline, Ill., is to abandon its quarry at Fifth Ave. and 25th St. and will fill the pit to the level of the street. The street and alleys committee of the Moline city council have granted the company permission to blast the hill 100 ft. south of the present quarry on condition that the company furnish a $50,000 bond to protect the city in case of accidents and to abandon all operations on the property after the pit is filled.

River Products Co., Iowa City, Ia., have started the expansion of their Coralville quarry to enable the plant to fill a number of rush orders for crushed limestone to be used in various construction projects. Beginning next week, the company will deliver 6 carloads daily for the paving of primary road 40, from Cedar Rapids to the Johnson county line. The quarry has also been furnishing 4 more carloads each day for the construction of the new university medical laboratories.

Swint Bros., Fremont, Ohio, have installed a new Marion electric shovel at their quarries, west of the city.

Lexington, Ky. The county quarry, located three miles west of this city, has been closed for the year on account of exhaustion of funds appropriated for its operation.

Miami, Mo. The U. S. war department is reported to have begun stripping operations near here on large limestone cliffs preparatory to opening a quarry to supply rubble for various improvement projects to be built along the banks of the Missouri river.

Western Granite and Marble Co., Hollister, Calif., announces the purchase of a site at the corner of San Benito and First Sts., on which a new plant will be established. H. Kelley is manager.

Kiggins Limestone Quarry Co., Hillsboro, Ill., held its annual meeting of stockholders recently and elected M. T. Kiggins, Walter Hall and Dennis Lanigan, all of Hillsboro, and J. K. and A. V. Williams, of St. Louis, directors for the ensuing year. New officers will be selected later by the board of directors. The quarry will continue to be operated under lease by Rynearson Bros. with Earl Rynearson as superintendent.

Sand and Gravel

Gadsden Sand and Gravel Co., Gadsden, Ala., (incorporation notice in June 26 issue) has purchased the G. H. Mathis farm in East Gadsden for $30,000. This tract is said to contain 92 acres, and to contain a deposit of building and molding sand. Felix Bowman, Gadsden, is president.

Union Rock Co., Los Angeles, Calif., recently entertained friends at the Baldwin Park plant at an annual barbecue affair. A huge tent was erected in which were the tables and benches for the guests. For entertainment there was a ball game between the teams of the construction division of the City Engineering Department and that of the Union Rock Company. Music by a special jazz orchestra and singing and dancing were featured. The guests were taken through the various parts of the plant, which is pronounced by experts the most modern and largest of its kind in the entire United States.

Greenville Gravel Co., Columbus, Ohio, suffered a fire loss of $300 recently from a workman's torch. Firemen were hampered by lack of water, and were required to pump water from the river.

Sand and Gravel Products Co., Star Brick, near Warren, Penn., is running almost at capacity. Several large contracts for sand and gravel for use in road construction are held by the company and several cars of washed sand and gravel are shipped daily. The product is of a high quality and is finding a ready market.

Ainsworth Gravel Co. has opened a new pit at East 65th St. North and Ainsworth Ave., Portland, Ore., to produce and sell road gravel and general sand and gravel. Officials of the company are F. E. Ellis, C. H. Bruhn and J. R. Finzel.

Auburn Sand and Gravel Co., with offices and pits one-half mile north of Auburn Heights, Royal Oak, Mich., has started production specializing in washed sand and gravel. V. J. Hess, 941 East Second street, Royal Oak, has been appointed hauling contractor by officers of the new company, insuring contractors and builders and the residents of the township prompt attention and delivery on all orders.

John Jansen and **T. F. Kelly** of Haxald, Mich., have purchased a tract of gravel land at that place from Homer Zipp and are planning to put up a washing and screening plant along with a cement products plant at the site.

Cedar Falls, Iowa, has agreed to purchase at a price of $2,000 the gravel deposit owned by C. A. Rownd.

Osage Gravel Co., Eldon, Mo., has resumed operations at Bagnell. The company is preparing a supply of gravel in anticipation of the time when work will be opened again on the Missouri hydro-electric dam.

Blue River Sand and Gravel Co., Marysville, Kan., have started work on the erection of two main buildings at their site on the Blue river.

Monessen Sand and Gravel Co., Monessen, Pa., has preliminary plans for a new local sand and gravel unloading plant, with complete equipment.

Janesville, Wisc.—Sand and gravel industry about this place is very active, an average of 275 cars per day being shipped from 9 pits.

East Liverpool Sand Co., East Liverpool, O., has been granted permission by the city council to install a drag-line cableway over the back channel of the Ohio river from Babb's island to the Ohio shore.

Standard Sand and Gravel Co. has begun work on dismantling the plant equipment at their pits near Casco Junction, Wisc. All the machinery and equipment will be shipped to Milwaukee. The plant was started several years ago, but operated only a short time.

Potter County, S. D., is having its sand and gravel deposits surveyed by the state geological survey in conjunction with the state highway department. The work has been undertaken primarily to locate materials for state and county highways under construction and for future information.

Cement

Central States Portland Cement Co., La Salle, Ill., being promoted by the Cowham Engineering Co., Chicago, Ill., will build a $3,000,000 plant of 1,000,000 bbl. annual capacity, according to announcements.

Superior Portland Cement Co., Concrete, Wash., was recently host to Sedro-Woolley Rotarians and their wives. The guests were royally entertained by Mr. and Mrs. C. L. Wagner of Concrete. The visitors were taken on an interesting trip to the huge power station, to Lake Shannon and the Baker river dam, after which they went to the cement company's quarry, and later through the Superior plant. Mr. Wagner and Mr. Jessup accompanied the delegation and explained all of the various processes and mechanical details. In conclusion, Mr. and Mrs. Wagner entertained their guests with an elaborate dinner at the Superior hotel. Speeches were given by Mr. Jessup, construction engineer who superintended the building of the dam; C. P. Shangle, retiring president of the Sedro-Woolley Rotary club, and Mr. Tongue, of Seattle, sales manager of the company. Mr. Wagner presided as toastmaster.

Mexican cement is the trade name of a new construction material patented by Luis L. Acuna, Tucson, Ariz.

Canada Cement Co., Ltd., Montreal, Que., has reopened its Hull, Que., plant. F. P. Jones, the president, confirms the report that this step has been taken, and states that the plant, which has been closed down for a number of years, will be operated 25% of capacity.

Calaveras Portland Cement Co., near San Diego, Calif., will use 15,000,000 k.w.h. per year of electrical energy, supplied by the Pacific Gas and Electric Co.

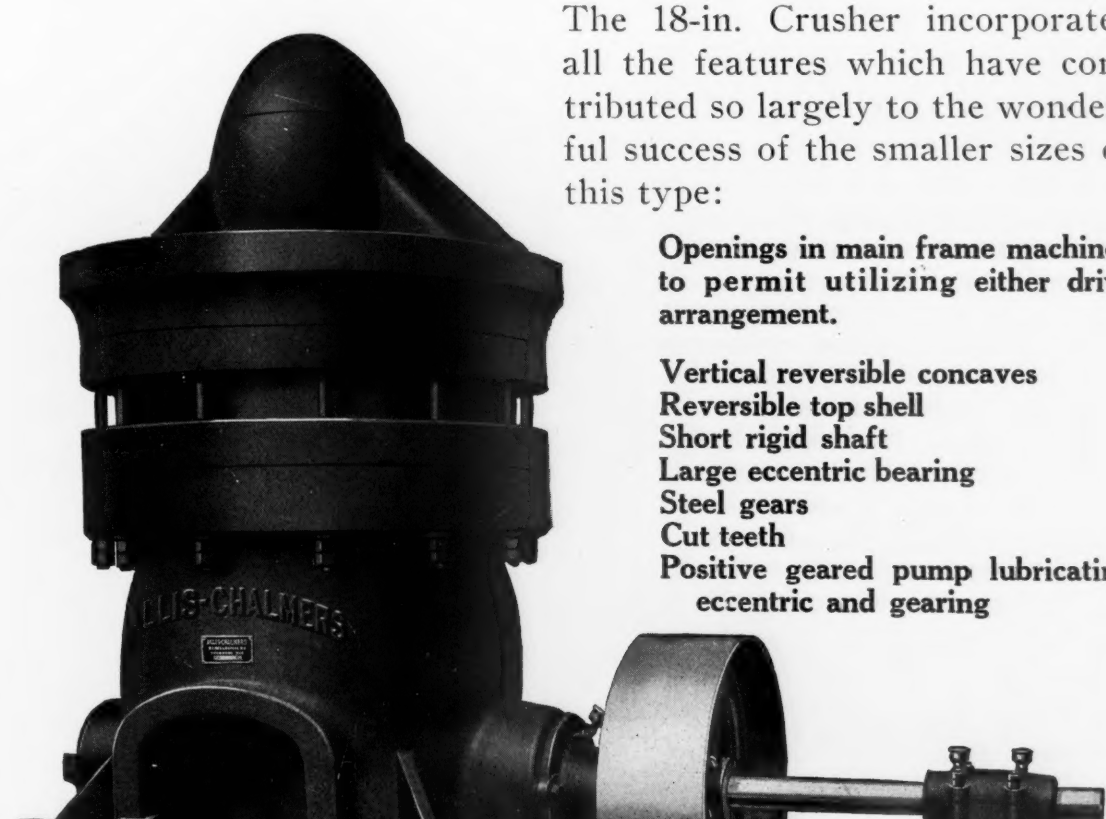
New 18-inch Superior McCully Fine Reduction Gyratory Crusher

The latest development in the Superior McCully Fine Reduction line, furnished to a large Cement Company--having two feed openings, each 18 in. by 68 in.--capable of taking the product from the largest size primary crushers --capacity with minimum discharge opening of 2 1-2 in.--225 to 275 tons per hour.

The 18-in. Crusher incorporates all the features which have contributed so largely to the wonderful success of the smaller sizes of this type:

Openings in main frame machined to permit utilizing either drive arrangement.

Vertical reversible concaves
Reversible top shell
Short rigid shaft
Large eccentric bearing
Steel gears
Cut teeth
Positive geared pump lubricating eccentric and gearing



ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

Florida Portland Cement Co., Tampa, Fla., entertained members of the Tampa Lions Club recently. In addition to the lunch served at the plant commissary, the Lions were shown over the work thus far completed on the new plant, and an outline of the work contemplated was given by C. A. McKeand, plant manager.

Cowell Portland Cement Co., Cowell, Calif., entertained over 400 employees and friends during the annual Fourth of July celebration at Cowell Town Hall. W. H. George, company manager, presided. Fireworks, a dance and banquet completed the evening's entertainment.

Colorado Portland Cement Co. played host to the Florence Lions Club of Florence, Colo. Prior to visiting the cement works a dinner was served at the Portland hotel and then the Lions and their guests were taken to the cement plant by the superintendent, E. J. Strock, and on a complete tour of the works, where they witnessed the entire process of cement manufacture.

The Canada Cement Co., Ltd., Montreal, Can., has secured a contract for 200,000 bbl. of cement from the Kimberley-Clarke Co. for their development at Kapuskasing, near Cochrane, Northern Ontario.

Alabama Portland Cement Co. is planning extensions and improvements to their plant at Birmingham, Ala., to cost about $250,000.

Cement Products

Sandusky Cement Co., Cleveland, Ohio, have recently published a 35-page book on concrete products containing some excellent data on their manufacture. Among other subjects treated are curing, concrete mixing, coloring, waterproofing, etc.

Pacific Stoneware Co., Portland, Ore., shipped more than 10,000 stoneware chicken fountains and rabbit-feeding dishes to markets in Oregon and Washington during June. The factory employs twenty men and orders are now being filled for stoneware shipments to Honolulu in large consignments.

Standard Art Stone Co., Portland, Ore., is now delivering the cast stone trim for the new million-dollar Masonic Temple in that city. The plant of the company has recently been enlarged and there has also been an increase of employees in the organization. Harry L. Burroc is president of the Standard Art Stone Co. and T. J. Schmidt is secretary-treasurer.

W. J. Millsap will engage in the manufacture of concrete products in Rupert, Ida., just as soon as his plant can be completed.

Birmingham Slag Co. will shortly place "Stone-tile," a cement product, on the market. Moulds to manufacture this product have been installed at both the Ensley and Alabama City plants. This company will also continue the manufacture of Slagtex tile, which is for light load-bearing construction, while "Stone-tile" is for heavy load-bearing.

Northern Stone and Supply Co., Minneapolis, Minn., is now producing in its new plant at 4728 Lyndale Ave. N., where they have remodeled an old brick plant and equipped it for the manufacture of cast stone. A unique feature of the new layout is the showrooms for the various stock designs. These were made by putting skylights in the top of the brick kilns, which then make unusually attractive vaulted rooms, where each design can be shown to itself. The plant covers five acres and they have 500 ft. of siding for shipping purposes. J. T. Harrington is general manager and W. R. Bell is sales manager.

Silica Sand

Pennsylvania Glass Sand Co., Berkley Springs, W. Va., plant was damaged recently to the extent of $100,000 when fire practically burned all buildings and damaged the equipment. The night watchman and people living near the plant tried to control the blaze with bucket brigades, supplementing the plant fire-fighting system, but could not overcome headway made early by the fire. Supports for the electric light wires were burned away, breaking power that pumped water into the plant.

Feldspar

Tennessee Mineral Products Co., Spruce Pines, N. C., is planning the erection of a feldspar grinding mill to cost about $250,000.

Rock Phosphate

Idaho Phosphate Co., Paris, Idaho, resumed operations at the mine Tuesday morning with a force of three men, after being closed down for the past six weeks. Ray McIlwee, manager of the company, has announced that the crew would be increased about the end of the month, when shipping to the Pacific coast of phosphate rock would commence at their works.

Miscellaneous Rock Products

E. W. Parker, Tampa, Fla., is reported to have started the organization of the Pyrite Brick Co. with a capital of $150,000 to manufacture brick from waste material from rock phosphate. A plant of 40,000 brick per day initial capacity is included in the plans.

Personal

C. B. King, general manager of the Marion Steam Shovel Co., Marion, Ohio, sailed recently from New York aboard the S.S. Mauretania for England, where he will spend a month or two observing the progress being made in the production of English built "Marion" shovels at the plant of Ransomes & Rapier, Ltd., at Ipswich. Mr. King will also make a survey of general business conditions as they exist at present in England, and before returning to the United States may visit several other European countries.

Richard Bernhard, chief engineer, and **Robert Reinhard**, assistant engineer, Traylor Engineering and Manufacturing Co., sailed recently for Chile. They are going to El Melon, near Calara, about 40 miles from Valparaiso, Chile, where the Sociedad Fabrica de Cemento de "El Melon" is going to erect a cement plant. Messrs. Bernhard and Reinhard are going to make the designs for the plant and the Traylor Engineering and Manufacturing Co., and the International General Electric Co. are to furnish the equipment for the complete installation. When completed, the plant will be able to turn out 1200 barrels of cement per day.

Mr. Bernhard will later visit Peru, Argentina and Brazil, returning to the United States at the end of about three months.

John L. Jackson and **E. D. Church**, president and treasurer, respectively, of Jackson & Church, manufacturers of sand-lime brick machinery and of sand-lime brick, Saginaw, Mich., are now on an extended vacation trip in Alaska.